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B. & O.'s Production Wheel Shop

The methods used in establishing a centralized wheel shop with details on its tools, equipment, operation and output

[This article is an abstract of a paper Mr. Rykoskey, supervisor of shops, Baltimore & Ohio, presented at the May 14, 1948, meeting of the Eastern Car Foremen's Association at New York. He introduced new data on the B. & O.'s wheel shop at Glenwood, Pittsburgh, Pa., a production wheel shop built in 1946 for which he was largely responsible. A description of this shop appeared in the August, 1946, issue of the *Railway Mechanical Engineer*. In his presentation Mr. Rykoskey supplemented his talk with a motion picture of this shop. Part of his paper dealt with comments on the violations of A.A.R. Wheel and Axle Manual standards and practices as found by the Mechanical Inspection Department of the A.A.R. there will be published in a later issue.—EDITOR.]

New wheels are unloaded from cars and moved directly to the boring mills by portable roller conveyors

By F. B. Rykoskey

THE maintenance of car wheels within limits set by the Association of American Railroads for the safe operation of trains is a problem of paramount importance to all railroads. With the increased speed of trains, cars of greater capacity, and the longer train haulage with Diesels as motive power the wheel-shop foreman must be more vigilant in wheel-shop inspections, and utilize every means at their command to impress all concerned that quality work is essential. Too many of us are car men instead of being supervisors. We neglect important things such as instructions and manuals on new methods and practices and we fail to administer such instructions. We cover too many details with correspondence, rather than to personally survey the operations for means to improve the workmanship and the relationship between the workmen and management.

The wheel-shop supervisor should schedule, maintain and constantly inspect the output of the shop. He should spend as much time as possible instructing his force in the use of the facilities and secure the greatest degree of precision possible while maintaining his output. Constant study of his operation should also be made in search of improvements and short cuts which can be made without sacrificing accuracy. Facilities which handle wheels and axles with a minimum physical effort are also fertile fields for study.

Wheel Shop Centralization

Studies of this nature have been made on the Baltimore & Ohio, where, prior to the time our new wheel shop at Glenwood, Pittsburgh, Pa., was placed in operation, we had ten wheel shops at strategic locations on the system equipped and manned to strip, bore and mount wheels, turn axles, and do the other operations involved. In addition, there were seven stations equipped to turn and burnish journals on mounted wheels where stripping of wheels was not required.

Our new wheel shop at Glenwood was put in full productive operation in April, 1946, and in a relatively short time mounted wheels were being produced in quantity sufficient to equal the combined output of six old wheel shops for cast-iron wheels, and four of these shops for steel wheels.

In addition to the Glenwood wheel shop we now have three shops producing cast-iron and steel wheels, one shop producing steel wheels only, and twelve outlying

stations equipped to true and burnish journals on mounted wheels. Facilities at outlying points for truing journals expedite release of cars and saves company hauling of mounted wheels to wheel shoes when stripping is not required. This hauling of wheels and axles is always a dominant factor in the overall cost of maintaining car wheels. The geographical location of Glenwood was one of the elements contributing to its selection as the site of the new wheel shop. It is centrally located in the territory serviced by its production.

The production in the Glenwood wheel shop requires between 30 and 50 per cent of the man hours per pair of wheels formerly required in the old abandoned wheel shops, and due to the large quantity of mounted wheels produced monthly, the savings in labor will amortize the investment in this project in approximately three years.

Planning a Production Shop

It is our practice, before recommending any improvement in facilities or practices, to make a cost study of the elements involved in the operations concerned. In our wheel-shop study, the man hours required was determined for every operation, as well as the handling of wheels and axles from the time they are brought into the wheel shop until they are taken out, either as finished mounted wheels or scrapped. This study was on the basis for estimated savings which would justify the investment in this project. The results obtained thus far have substantiated our prediction of savings to be effected, and the accuracy of the mounted wheels produced is gratifying.

In planning a production wheel shop, wheel storage tracks of sufficient capacity to store at least two weeks of wheel supply for an efficient and economical output of the shop are necessary. At the Glenwood wheel shop we have tracks that will store 12 to 15 hundred pairs of wheels. These wheels when unloaded are stored on the tracks by size and separated from those wheels that need only journal-truing and tread-turning attention. The wheels requiring remounting are inspected and marked to indicate the wheels to be scrapped and the wheels to be reclaimed.

The scheduling of the shop is based on one size of wheels per day. As an illustration, five-by-nine wheels may be run through the shop for a period of two to three days in succession without any interruption, and the following day another size of wheels may be scheduled through the shop for a day's production. Very seldom mixed sizes of wheels are scheduled through the shop at one time. Steel and cast-iron wheels are scheduled through the shop in the same manner.

Stripping Wheels

After the wheels are rolled into the stripping press, perforated collets are applied for protection of the journal which may be damaged by the wheels as they are pressed off. This operation is performed by a Chambersburg 600-ton press, and both wheels are pressed off simultaneously. The actual operation of pressing off both wheels is done at an average of 58 seconds per pair of wheels. The average number stripped per eight-hour day, including handling to and from the press, removal and disposal of wheels and axles, is 112 pairs.

After the wheels are pressed loose, the axle and the loose wheels are rolled out of the press and wheels are placed on dollies which hold them in an upright position; the axle is suspended from an electric hoist, and loose wheels are removed from the axle by moving the dolly and wheel as a unit.

Disposal of Scrap and Reclaimed Wheels

Scrap and reclaimed wheels are removed from the dolly by a pneumatic lift crane and placed into a pneumatically operated elevator. They are disposed of by raising the elevator to an opening where they are discharged into a chute. Second-hand wheels are disposed of in the same manner and roll down to a retarder at the end of the chute to keep the wheels from impacting against one another when descending.

The chute leads into three outside scrap bins. Switches are located at each of the bins for wheel disposal, and these switches are controlled by air valves located at the side of the elevator shaft within the shop. The operator

Assembling wheels and axles for mounting

can either dispose of the wheel in the steel scrap bin or cast-iron scrap bins, or close all switches and cause the wheel to roll to the retarder when wheels are reclaimed.

Recentering and Sorting Axles

After wheels are removed from axles the latter are then recentered, wheel seats micrometer calipered and the required diameter of the finished wheel seat marked on the axle according to the nearest step size in 1/32-in. steps.

Since the allowable variation for wheel-seat diameters between the new oversize dimension and shop limits is ⅜ in. this means 13 step sizes of 1/32 in. can be obtained on each size axle. These step sizes have been numbered 1 to 13. For example, on a 5-in. by 9-in. axle, the shop limit for wheel-seat diameter is 6¼-in. Therefore wheel-seat size No. 2 would be 6-9/32-in. or 6.281 in. Both wheel seats of each axle are turned to specified size in the axle lathe. A chart record is kept showing the number of axles available for each step size. This chart is furnished the boring-mill operators who bore the wheels accordingly, allowing for the tolerance to obtain required mounting pressure.

After the axles have been recentered, wheel seats calipered and numbered for proper size, they are ready to go to the axle lathes for machining.

The centering machine is a single-end type, electrically driven, but a new double-end centering machine, electrically driven, is now on order for use in this shop, which will recenter both ends of an axle simultaneously and also recenter axles with mounted wheels.

Axle Handling

All axles for a full day's production of the axle lathes are stored on racks at the individual machines on the second trick, eliminating any congestion or interference of axle handling during the full day's production of output. These axles are stored in these racks for step-size machining. The axle wheel seats are machined in 1/32-in. step sizes and the boring mills are scheduled for these sizes for a day's production. The axles are distributed to the various axle lathes by means of a mechanically operated pallet conveyor. They are moved from the conveyor to the racks and to the axle lathes by individual electric jib cranes located at each machine.

Axle-Lathe Operation

The axles are turned on center-drive Niles axle lathes, turning all wheel seats and journals on axles where new wheels and reclaimed wheels are applied. These machines operate at 75 r.p.m., with 3/16-in. feed, and the output of each axle lathe is 16 axles per machine per eight-hour day. OK and Apex high-speed tools are used in this operation. Dial micrometers with Stellite tips are used for the measuring of the wheel seats. Cimcool coolant has proved very satisfactory as a cooling agent in machining of the axles.

Magnaflux Inspection of Axles

After wheel seats and journals are turned, the axles are inspected for cracks or flaws by the Magnaflux method of inspection. The dry method is now used. However, a Magnaglo machine of special design for testing car axles will be installed in this shop in June, wherein the inspection medium consists of Magnaglo paste suspended in oil. In this method the axles are placed under a hood which excludes bright light and inspection is made under a black light. Cracks or flaws are readily seen in fluorescent form as the axle revolves on motor driven rollers. This improved method will greatly facilitate inspection of axles in this shop.

Burnishing of Axle Journals

The axle burnishing lathe is a Niles double-end type, furnished complete with opposed Stellite burnishing rolls, Neilson Timken bearing tail stock, integral centers, with speeds of 75 and 150 r.p.m. The output of the burnishing lathe is 55 axles in eight hours. All burnishing of dismantled axles is done on the burnishing lathe, which is operated on two eight-hour shifts.

Handling New Wheels to Boring Mills

Located at the loose-wheel storage platform are two enclosed steam-heated gravity-feed roller conveyors. These conveyors are equipped with a pneumatically operated hinged gate whereby a wheel is placed in a vertical position on the gate, and by operating an air valve the gate is raised in line with the conveyor, and the wheel descends by gravity feed to the wheel boring mills inside the shop.

Wheel Boring Mills

Wheel boring facilities consist of two 48-in. Niles plain hydraulic-feed borers. They are equipped with five-jaw chucks with hub-facing attachment operated by hydraulic feed and traverse, and with a table brake and automatic feed attachment. The boring bars are Davis No. 7½ special 2-in-1 with A & B cutters. Each boring mill is equipped with right-hand and left-hand cranes; wheels being placed on the borer from the right and finished wheels being removed from the borer to the left.

All wheels are bored to chart sizes of axle dimensions, with proper tolerances allowed to obtain the required mounting pressure. Roughing and finishing cuts for cast-iron wheels are at 125 r.p.m., ¾-in. feed. Steel wheels are roughed at 70 r.p.m., and finished at 39 r.p.m. Carbide tools are used on both types of wheels for both the roughing and finishing cuts. These carbide tools are furnished by the Carey-McFall Co. An average output of 112 cast-iron wheels per machine per eight hours, or 55 steel wheels per eight hours is obtained.

Handling of Wheels and Axles to the Press

After the wheels and axles are finished, they are conveyed to the mounting press and are ready for mounting. The wheels are placed on dollies in a vertical position and the axle is placed on an axle jack, which can be raised or lowered to permit entry of journal into the wheels. Collets are used for protection of the finished journal. After the wheels are entered, the axle jack is lowered and the wheel pair is rolled into the mounting press. The mounting press is a reconditioned 400-ton Niles Bement Pond press.

The left wheel is pressed on first and when the ram is released, a pneumatic plunger engages the left end of the axle and slides the wheels to the right. The end of the axle is then blocked at left and the block is removed from the ram at the right, allowing the ram to contact the right wheel, which is then mounted.

After mounting, the pair of wheels is rolled through to the opposite side of the press and either loaded directly on a wheel car inside the shop or transported by dolly to the outside storage tracks, from which point they are loaded onto a wheel cradle car for shipment. This press mounts 100 pairs of wheels in eight hours.

Truing Journals of Mounted Wheels

The journal truing lathe is a Betts Bridgeford gap-type, double-end machine having each carriage equipped with an opposed-type burnishing attachment, roller-bearing built-in type Timkenized tail stocks, speed changes 30-47-52 r.p.m., and four feed changes, .0137 in. to .046 in.

(*Continued on page 77*)

Evolution of

Side Frames and Bolsters

By Robert Boyd Cottrell†

A chronological review of changes in the form of cast-steel freight-car trucks showing revisions in weights and the improvements in their strength and stiffness

THE modern high-speed freight-car truck is one of the most efficient and economical structures in the transportation field. This part of the present-day 50-ton freight car has a weight complete of about 14,000 lb. in Grade B steel, and is capable of transporting 110,000 lb. of material safely and without damage at speeds up to 100 m.p.h. The trucks also support the car body, which in some cases weighs 40,000 to 45,000 lb., making 150,000 to 155,000 lb. in all. This is 11 lb. of load carried per pound of weight.

The cast steel truck bolster in a modern 50-ton freight-car truck actually supports about 90 lb. per pound of its own weight, and the cast steel side frame about 65 lb. per pound of weight. If we disregard the car body and only consider the lading carried, we find the cast steel bolster capable of carrying 65 lb. and the cast steel side frame 46 lb. of revenue freight per pound of their own weight. It must be remembered that the truck is also called upon to carry the brake system or retarding means. This amounts to about 425 lb. in a 50-ton truck, not counting the brake support means on the side frames and bolsters. Further analysis shows that the forged steel axles carry 34 lb. of revenue freight per pound of weight and the one-wear steel wheels 24½ lb., indicating the excellent efficiency and weight economy of the cast-steel side frame and bolster.

The early designer had very little, if any, data as to the dynamic loads, etc., to which a side frame or bolster was subjected in service, and naturally a few designs did not prove as serviceable as expected. While the static loads were known and the designs figured amply strong, it was apparent that the dynamic loads in service must be considerably higher in order to account for these failures. It was not until 1913-1914 that the first attempt, and a successful one, too, was made to measure the dynamic loads imposed on side frames and bolsters in service. With this information and the strain gauge, which was developed about this time, the designing engineer was able to study the structures more intelligently, determine the effect of changes in design and metal distribution, and thereby provide cast-steel side frames and bolsters with maximum strength and minimum weight. This was not achieved in one or two years, but has been a gradual transition based upon a scientific approach, each step being thoroughly tested not only in the laboratory by static and fatigue testing equipment, but finally by actual performance in service.

The writer first became associated with the manufacture, testing, and design of cast steel side frames and bolsters in 1914. It may be of interest to recall the designs that were in vogue at that time and the various changes that have taken place since then.

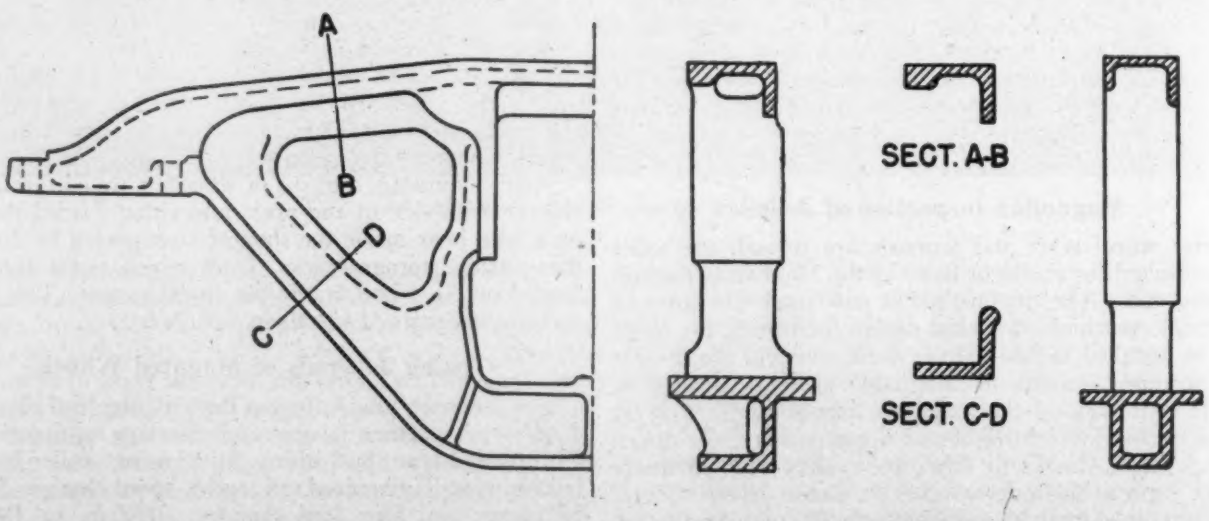
Evolution of Side Frames and Bolsters

A design of Andrews side-frame extensively used around 1910 to 1920 is illustrated. At the left is the side elevation of half of the frame and at the right is a section at center, and also sections taken through the tension and compression members. This was known as an L-section frame. To increase strength and rigidity, the bulb portion of the compression member at the front side was increased in depth and the bottom member below the spring seat was made into a box section.

The next step was to eliminate the bulb portion of the compression member, as it was difficult to cast it without shrinkage. The compression member was made of an inverted U section which added greatly to the strength at no increase in weight and also was of considerable help

*A paper presented at a Railroad Division session during the annual meeting of the American Society of Mechanical Engineers held at Atlantic City, N.J., December 1-5, 1947.

†Chief mechanical engineer, American Steel Foundries, Chicago.



Left: An early design of Andrews side frame—Section at right: Bulb portion of the compression member eliminated

to the foundry. A section of this design is shown at the right of the Andrews side frame. Another idea that was tried out about this time was the use of upstanding flanges at the edges of the horizontal web of the top or compression member. This did not meet with a great deal of favor and was not used very extensively.

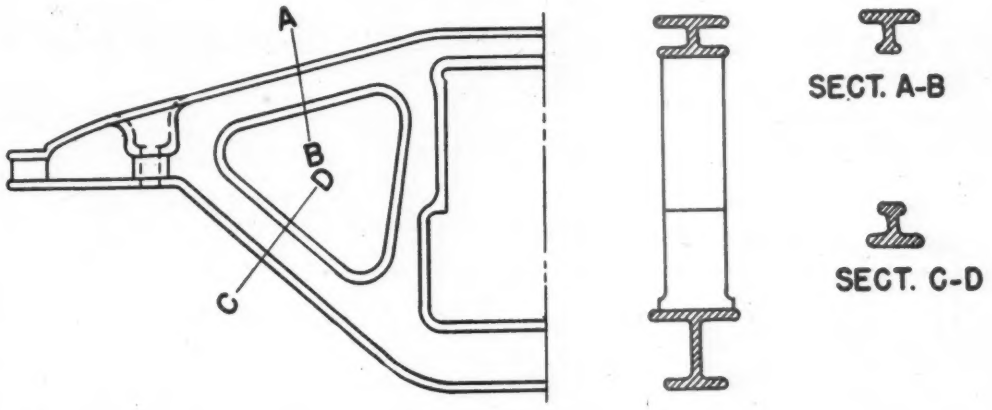
Another form of side frame in use about this same time was known as the I-section frame. These designs went through the same general changes as the L-section frames, finally ending up with inverted U section compression members and I-section tension and bottom members.

Static tests and strain-gauge analyses made from 1914 to 1918 clearly indicated the superiority of the U section, and designs began to appear in which the tension member, as well as the compression member, was made this way, although cost of manufacture was increased due to additional coring, etc. The best known example of these early U-section frames was the U.S.R.A. designs. They were completely U-section with the exception of the bottom box member below the spring seat. This was the foundation upon which our present-day designs rest. The casting of the journal boxes integral with the frame and the use of reentrant flanges, cross ties, beads and pocket type spring seat has resulted in an exceptionally strong yet lightweight structure.

A side frame for a modern high-speed freight car truck is shown in one of the illustrations. It can be seen that space has been provided for long-travel load-carrying springs and control device so necessary to safe and easy riding, all without encroaching on the space given the truck manufacturer by the car builder and the A.A.R.

Table I—Proof Tests of Side Frames—1912 Specifications—Grade B Steel

Car capacity, lb.	Initial load, lb.	Proof tests		
		Load, lb.	Maximum deflection, in.	Maximum set, in.
80,000	20,000	110,000	0.15	0.01
100,000	25,000	135,000	0.15	0.01
140,000	35,000	175,000	0.15	0.01



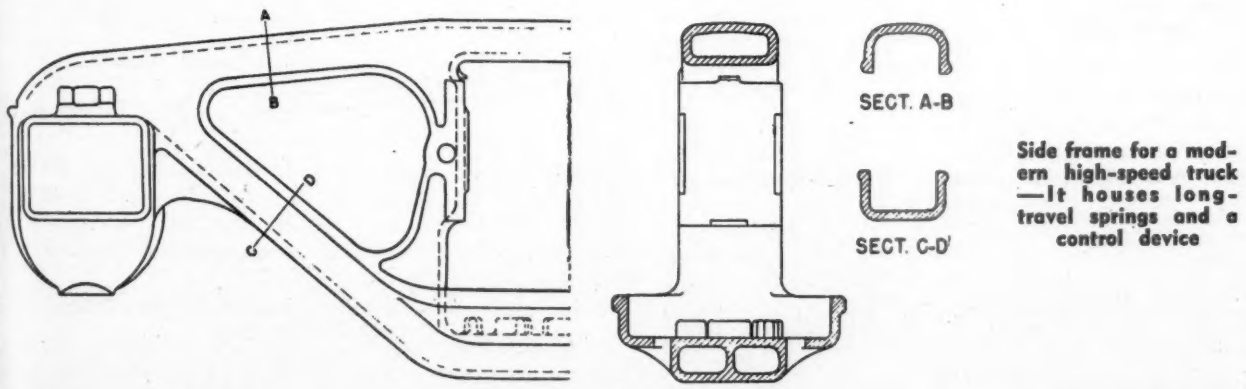
A typical example of an I-section side frame

Table II—Weights of Side Frames—Grade B Steel

Car capacity, lb.	Weights, lb.		
	Minimum	Normal	Maximum
100,000	485	500	515
140,000	640	660	680

The above weights generally referred to Andrews type side frames, which were used so extensively at that time. If we add the journal boxes, bolts, and tie bars for comparison with modern integral box frames, the weights would be as follows:

100,000	805	820	835
140,000	1,030	1,050	1,070

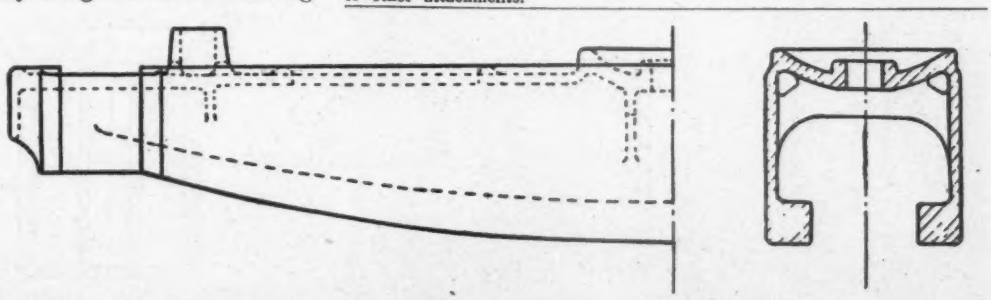


Side frame for a modern high-speed truck—It houses long-travel springs and a control device

Table III—Weights of Truck Bolsters—Grade B Steel

Car capacity, lb.	Weights, lb.		
	Minimum	Normal	Maximum
80,000	660	680	700
100,000	740	765	790
140,000	945	975	1,005

Note—Integral center plates exclusive of side bearings, fulcrum brackets or other attachments.



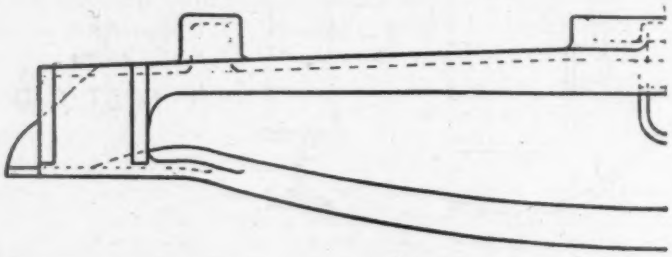
An early inverted U-section truck bolster

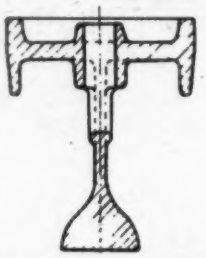
Progress in cast-steel truck-bolster design has kept pace with that of side frames and is equally as impressive.

Table IV—Test Requirements of Side Frames—Grade B Steel

VERTICAL

	Car capacity, lb.		
	80,000	100,000	140,000
Initial load or zero reading	5,000	5,000	5,000
Load for 0.063-in. max. deflection	72,000	90,000	112,500
Load at 0.031-in. max. set	144,000	180,000	225,000
Minimum breaking load	288,000	360,000	450,000
TRANSVERSE			
Initial load or zero reading	5,000	5,000	5,000
Load for 0.094-in. max. deflection	19,200	24,000	30,000
Load at 0.031-in. max. set	38,400	48,000	60,000

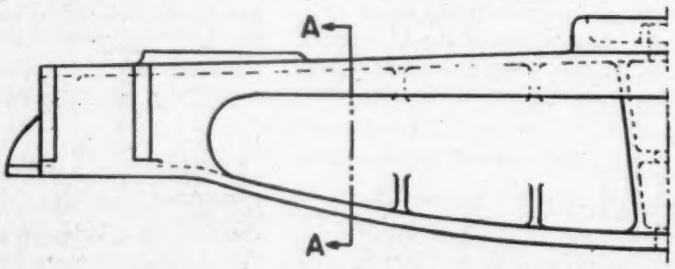




A bulb-section truck bolster

Corresponding to the L- and I-section side-frame period, the bolsters were of what was known as the inverted U- and bulb-section designs. Typical examples of these constructions are shown.

The bulb-section was superceded by the T-section bolster



SECTION A-A

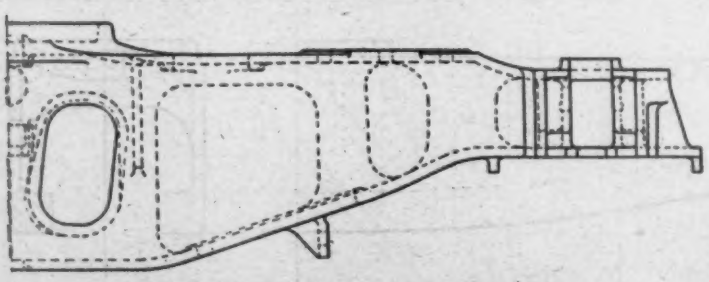
Table V—Test Requirements of Truck Bolsters—Grade B Steel

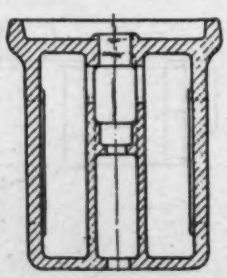
VERTICAL—CENTER PLATE

	Car capacity, lb.		
	80,000	100,000	140,000
Initial load or zero reading	5,000	5,000	5,000
Load for 0.075-in. max. deflection	93,000	115,500	144,000
Load at 0.031-in. max. set	186,000	231,000	288,000
Minimum breaking load	372,000	462,000	576,000
TRANSVERSE			
Initial load or zero reading	5,000	5,000	5,000
Load for 0.075-in. max. deflection	62,000	77,000	96,000
Load at 0.031-in. max. set	124,000	154,000	192,000

The bulb-section was superseded by the so-called T-section for strength as well as foundry reasons. The full box-section cast-steel bolster came out about the same time the full U-section side frame made its appearance. A considerable improvement was made in strength, but cost of manufacture went up due to the internal coring that was necessary.

The box-section bolster construction, like the U-section side frame, has demonstrated by test and service its superiority from a strength and weight standpoint. Refinements have been made such as straightening bottom and top members, judicious use of internal ribbing, holes through side walls for brake rods, etc. Such a design is shown in one of the illustrations.





The refined box-section bolster

Table VI—Weights of Integral-Box Side Frames and Bolsters—Grade B Steel—1926 to 1929

Car capacity, lb.	Weights, lb.	
	Side frames	Bolsters
80,000	545	720
100,000	600	800
140,000	760	1,015

Table VII—Test Requirements for Truck Bolsters as Revised in 1931—Grade B Steel

VERTICAL—CENTER PLATE

	Car capacity, lb.		
	80,000	100,000	140,000
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.075-in. max. deflection	93,000	115,500	144,000
Load at 0.025-in. max. set	186,000	231,000	288,000
Max. load not less than	341,000	423,500	528,000
VERTICAL—SIDE BEARING			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.055-in. max. deflection	93,000	115,500	144,000
Load at 0.025-in. max. set	155,000	192,500	240,000
TRANSVERSE			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.075-in. max. deflection	62,000	77,000	96,000
Load at 0.025-in. max. set	124,000	154,000	192,000

Table VIII—1936 Test Requirements for Side Frames—High-Tensile Steel

VERTICAL

	Car capacity, lb.		
	80,000	100,000	140,000
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.06-in. max. deflection	72,000	90,000	112,500
Load at 0.01-in. max. set	144,000	180,000	225,000
Minimum breaking load	384,000	480,000	600,000
TRANSVERSE			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.12-in. max. deflection	19,200	24,000	30,000
Load at 0.01-in. max. set	38,400	48,000	60,000

Concrete evidence of the steady advance is, I believe, well illustrated by the following facts and figures:

The M.C.B. (recommended practice) Specifications of 1912 (modified in 1914 and 1915) for Cast Steel Truck Sides required proof tests for 40-, 50-, and 70-ton side frames, as shown in Table I.

Weights for 50- and 70-ton side frames were specified as shown in Table II.

Similar specifications for cast steel truck bolsters had no proof test requirements but called for weights as shown in Table III.

It is interesting to recall that these early M.C.B. Specifications did not include a requirement of "ultimate load" or "breaking load."

In 1925 the Car Construction Committee of the Association of American Railroads, after consultation with the manufacturers of cast-steel side frames and bolsters, presented certain requirements for design and tests which were adopted as Recommended Practice in 1926. The test requirements for side frames are given in Table IV and those for bolsters in Table V.

Table IX—1936 Test Requirements for Truck Bolsters—High-Tensile Steel

	Car capacity, lb.		
	80,000	100,000	140,000
VERTICAL—CENTER PLATE			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.12-in. max. deflection	93,000	115,500	144,000
Load at 0.025-in. max. set	186,000	231,000	288,000
Minimum breaking load	341,000	423,500	528,000
VERTICAL—SIDE BEARING			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.08-in. max. deflection	93,000	115,500	144,000
Load at 0.025-in. max. set	155,000	192,500	240,000
TRANSVERSE			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.12-in. max. deflection	62,000	77,000	96,000
Load at 0.025-in. max. set	124,000	154,000	192,000

Weights of representative cast steel integral box side frames and truck bolsters of the 1926 to 1929 era are given in Table VI.

In 1929 the Car Construction Committee of the Association of American Railroads, in collaboration with the manufacturers, again increased the severity of the test requirements for side frames. While the load at which the vertical deflection and set readings was maintained, the amount of deflection permitted was reduced from 0.063 in. to 0.04 in. and set from 0.031 in. to 0.01 in. At the same time the minimum breaking load was increased from 9 times axle capacity (See Table IV) to 12 times axle capacity. The transverse requirements also were stiffened as the deflection was reduced from 0.094 in. to 0.070 in. and set from 0.031 in. to 0.010 in.

Table X—Present Test Requirements for Side Frames—Grade B and Grade C

	Car capacity, lb.		
	80,000	100,000	140,000
VERTICAL			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.040-in. max. deflection Grade B	72,000	90,000	112,500
Load for 0.055-in. max. deflection Grade C	72,000	90,000	112,500
Load at 0.010-in. max. set Grades B and C	144,000	180,000	225,000
Minimum elastic limit Grades B and C	136,000	170,000	212,500
Minimum breaking load Grades B and C	400,000	500,000	625,000
TRANSVERSE			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.070-in. max. deflection Grade B	19,200	24,000	30,000
Load for 0.120-in. max. deflection Grade C	19,200	24,000	30,000
Load at 0.010-in. max. set Grades B and C	38,400	48,000	60,000

The design test requirements for truck bolsters were revised in 1931 and are shown in Table VII.

Although the side frame and truck bolster specifications again were revised in 1937 and 1938, no change was made in the test requirements. The year 1936 saw the first tentative requirements for side frames and bolsters made of high-tensile steel. The permitted limits are shown in Tables VIII and IX.

This year saw the adoption of the 1947 specifications which increased slightly the ultimate load requirement for side frames and reduced materially the deflection requirements for high-tensile castings. The present-day requirements for Grade B and high-tensile side frames are shown in Table X and those for bolsters in Table XI. These requirements should be compared with those in Table I in order to realize the great increase in strength of cast-steel side frames and bolsters that has occurred in the last 35 years.

Table XI—Present Test Requirements for Truck Bolsters—Grade B and Grade C

	Car capacity, lb.		
	80,000	100,000	140,000
VERTICAL—CENTER PLATE			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.075-in. max. deflection Grade B	93,000	115,500	144,000
Load for 0.105-in. max. deflection Grade C	93,000	115,500	144,000
Load at 0.025-in. max. set Grades B and C	186,000	231,000	288,000
Minimum breaking load Grades B and C	341,000	423,500	528,000
VERTICAL—SIDE BEARING			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.055-in. max. deflection Grade B	93,000	115,500	144,000
Load for 0.070-in. max. deflection Grade C	93,000	115,500	144,000
Load at 0.025-in. max. set Grades B and C	155,000	192,500	240,000
TRANSVERSE			
Load for zero setting of instruments	5,000	5,000	5,000
Load for 0.075-in. max. deflection Grade B	62,000	77,000	96,000
Load for 0.120-in. max. deflection Grade C	62,000	77,000	96,000
Load at 0.025-in. max. set Grades B and C	124,000	154,000	192,000

For the purpose of comparing weights of these modern designs with those of 1912, Table XII has been included. Weights are given for both Grade B and high-tensile steel castings.

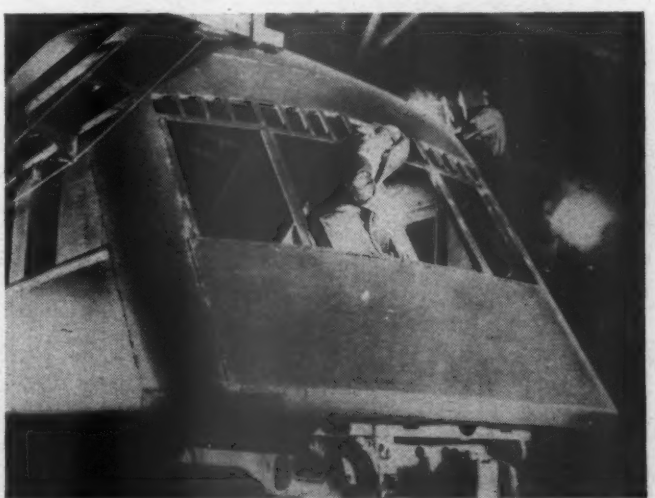
These figures serve to illustrate the great strides that have been made in the design of cast steel side frames and bolsters for freight car trucks. Not only has the strength of the castings been greatly increased but it has been accomplished without a corresponding increase in weight.

Table XII—Weights of Present-Day Side Frames and Bolsters

Car capacity, tons	Side frames, lb.		Truck bolsters, lb.	
	Grade B	High-tensile	Grade B	High-tensile
40	520	460	754	598
50	596	517	852	655
70	773	617	1,043	786

Credit for this progress in freight car trucks rightfully belongs not only to the engineer and designer, but likewise to the metallurgist and foundryman who have made very substantial improvements in steel and quality of castings. The close association and cooperative efforts of these men have made possible the present strong, safe and dependable cast steel side frame and bolster. This achievement is all the more remarkable when it is realized that these modern side frames and bolsters are used in freight car trucks capable of the safe and rapid transportation of commodities at speeds up to 100 m.p.h.

* * *



Welding a passenger car of high-strength steel—The Carnegie-Illinois Steel Corporation reports an 80 per cent increase over last year in tonnage of high-strength steels shipped to customers—Based on experience in a number of fields, these steels are said to go one-third farther when substituted for carbon steel

Future Railway Fuel—

Will It Be Oil or Coal?

THE prospects for a continued increase in the use of petroleum distillates as the major source of energy for the movement of railway trains, for household and other space heating, and for industry versus the continued use of coal-burning railway motive power were the theme of the meeting of the New York Railroad Club held on April 15. The speakers were Dr. W. J. Sweeney, vice-president of the Standard Oil Development Company, New York, who discussed the availability and use of petroleum products by the railroads, and Earl C. Payne, consulting engineer, Pittsburgh Consolidation Coal Company, Pittsburgh, Pa., who dealt with the coal outlook for railway fuel. Mr. Payne is also chairman, Motive Power Committee, Bituminous Coal Research, Inc., and a member of the Steering Committee Mechanical Advisory Group Locomotive Development Committee. The National Defense aspect of the fuel situation was brought into the discussion by Brig. Gen. Paul F. Yount, acting chief transportation department, United States Army, during the discussion of Dr. Sweeney's paper.

The outlook was discussed by speakers from the petroleum and coal-mining industries at the April meeting of the New York Railroad Club

Abstracts of the papers and a resume of the discussions follow.

Will There Be Fuel for Diesels?

By Dr. W. J. Sweeney

Petroleum products—fuel and lubricants—began their career of service in railroad Diesels in this country almost a quarter of a century ago when the first Diesel-electric switcher was put into operation. As the number of Diesel-electric locomotives has increased and as they have been used on longer and more important runs, the demand for Diesel fuel has increased rapidly. Today the rate of consumption is about 56,000 barrels a day. We estimate that about three million horsepower of new railroad Diesels will be built in this country each year for the next five years. At a fuel consumption rate of three barrels per horsepower-year, railroad Diesel fuel demands will increase about 25,000 barrels a day every year until 1953. It seems a safe estimate that the railroads in this country at that time will be using about 180,000 barrels a day of Diesel fuel oil. On the basis of the 1945 figures for haulage, we estimate that if all railroad duties were taken over by Diesels the total consumption of Diesel fuel would be in the neighborhood of 300,000 barrels a day.

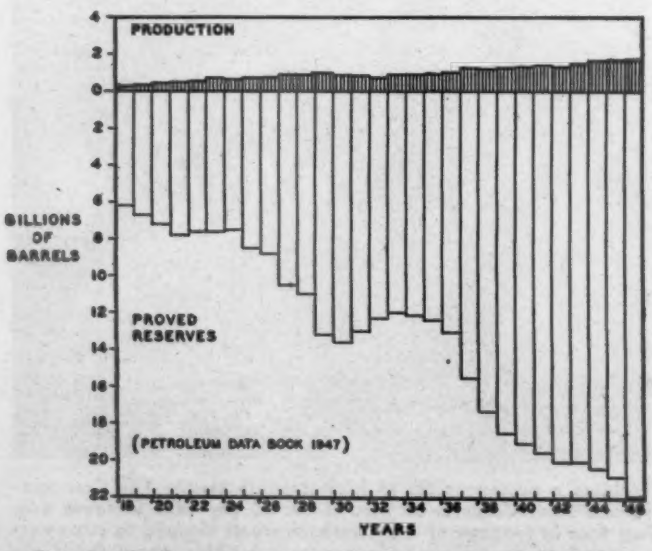


Fig. 1—Crude petroleum production in the United States compared to proved reserves

Fuel Economy

One of the major reasons for the shift to Diesel engines has been fuel economy. For the first six months of 1945 and 1946 the Interstate Commerce Commission presented figures on fuel consumption for the Class I railroads in the United States. On the basis of these figures the relative thermal efficiencies of coal, fuel oil and Diesel fuel are as shown in Table I.

Other reasons variously mentioned for the switch to Diesel-electric locomotives are smoke abatement, less wear and tear on tracks, better service factor, ability to handle a wide variety of assignments, economy in servicing facilities, maximum use of investment, conservation of manpower, higher continuous speeds, and less delay in required stops for fuel, water and cleaning.

[Dr. Sweeney then discussed Diesel lubricants and specifications for Diesel fuels and dealt with lubrication tests being conducted by the Standard Oil Development Company on a 2,700-hp. Electro-Motive Diesel locomotive on the New York, Ontario & Western. This portion of his paper will be the subject of an article in a later issue.—Editor.]

Fuel for Diesels

Fig. 1 shows the crude-oil production and the proved reserves in the United States for the years 1918 to 1946. It will be noted that the billions of barrels of proved reserves year by year have been continually growing larger. As of 1946 the proved reserves are about a dozen times greater than the production rate.

Table I—Heat Consumption of Coal- and Oil-Fired Steam Locomotives Compared with Diesels

	Coal-fired steam		Oil-fired steam		Diesel		Ratio coal to Diesel	
	1945	1946	1945	1946	1945	1946	1945	1946
Switch engines: B.t.u. per loco.-hr. (000)	11,100	11,300	9,010	9,250	845	850	13.0	13.0
Freight engines: B.t.u. per ton-mile	1,600	1,665	1,220	1,290	238	224	6.7	7.4
Passenger engines: B.t.u. per car-mile (000)	226	232	142	142	39	39	5.8	6.0

Production and consumption will, we feel, go up as years go by. New reserves will also be found, but the ratio of new reserves to future consumption is not presently determinable.

It is obvious that we are not faced with an immediate shortage of oil—certainly not so immediate that we cannot do something about supplies of liquid fuels by the application of already proved synthetic methods. Estimates have been made which indicate that the coal reserves alone are sufficient, if converted to oil, to supply oil for over 1,000 years at the present rate of consumption. In addition to coal, there are large reserves of other carbonaceous raw materials such as shale, natural gas and tar sands.

Table II—U.S. Domestic Demand for Crude and Products, Thousands of Barrels Daily

	1938	1944	1946	1947	Per cent increase over 1938
Gasoline	1,433	1,728	2,013	2,178	60
Kerosene	154	196	244	281	80
Diesel	58	192	148	200	250
Other distillate	264	380	517	617	130
Residual	800	1,399	1,307	1,420	80
Other	406	671	678	753	80
Total	3,115	4,566	4,907	5,449	75

Table II shows the demand in the United States for various petroleum products over the ten-year period 1938-1947. It will be noted that over the nine-year period the total crude oil requirement has increased about 75 per cent, whereas the Diesel fuel requirement has increased 250 per cent. Also, the other major products with which Diesel demands compete increased at a faster rate than total demands. Kerosene, for example, increased 80 per cent and other distillate fuels 130 per cent. The railroad Diesel fuel demand has increased even more rapidly during this same period. There is, however, a reasonable saturation value to needs of the railroads and such a rate of increase will eventually approach a limit of 300,000 barrels daily, namely about six per cent on crude.

While this is relatively small based on the total of petroleum products, there could be a problem in connection with supply for the following reasons:

(1) The rate of increase for railroads is exceptionally high compared with the rate of increase for petroleum products generally.

(2) The type of product competes with distillate fuels generally which also show an abnormal increase in demand, particularly kerosene and Diesel fuels for other applications than railroads.

(3) The quality of Diesel fuel being demanded exceeds, in spot situations, that easily obtainable from the crude available. In other words, relaxation of specifications or added processing equipment might be necessary to produce the volume required.

Quantity and Quality

In any petroleum supply problem two factors are interdependent. They are quality and volume. The less restrictive the quality the easier it is to attain a given volume. It is assumed that railroads in the competition for what has sometimes been termed "the middle of the barrel" do not desire to limit their chances of obtaining their requirements by unnecessary quality specifications. Believing this to be true, our fuel studies are primarily geared to finding out what properties are really important in performance, so that no unnecessary limitations will be placed on volume available for railroad use.

Users' specifications for railroad Diesel fuels are shown in Table III. The following may be noted:

(1) Flash point appears to be limited at 150 deg. F. Possibly 120 deg. would be satisfactory. Such a flash point has been used in kerosene, and kerosene or blends thereof have been used satisfactorily in bus and truck Diesels.

(2) Cetane number requirements seem to average about 45; some purchasers demand 50. Are these qualities necessary to the satisfactory performance of the engines for which they are specified?

(3) Sulphur content varies from 0.5 to 2.0 per cent. Is the lower limit really needed when specified?

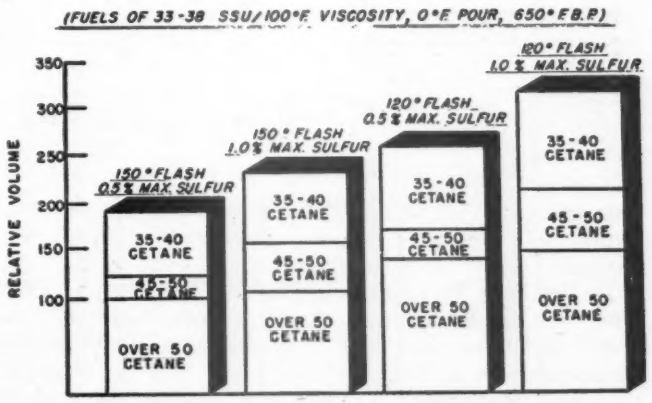


Fig. 2—Effect of Diesel-oil specifications on the Diesel fuel content of the crude

Fig. 2 shows what one refiner could do to extend supplies of railroad Diesel fuels from his present pool of crude-oil stocks. Starting with a restrictive specification base of 50 minimum cetane number, 0.5 per cent maximum sulphur and 150 deg. F. minimum flash, the following could be done at the expense of other products:

(1) 45 per cent increase of 50-cetane-number provided the flash could go to 120 and the sulphur to 1.0.

(2) 80 per cent increase of 150-deg. F. flash and 0.5 sulphur if the cetane could be dropped to 35.

(3) 130 per cent increase of 150-deg. F. flash if the sulphur could go to 1.0 per cent and the cetane to 35.

(4) 220 per cent increase if the flash could go to 120 deg. F., the sulphur to 1.0 per cent and the cetane number to 35.

We do not at present know how many of these relaxations can be tolerated and still get good engine

Table III—Specifications of Diesel Locomotive Fuel

Inspection	Average of Five Engine M'f'r's. Spread	Average of Five Engine M'f'r's. Average	Average of 14 Railroads Spread	Average of 14 Railroads Average
Viscosity at 100 deg. F., Seconds, Saybolt Universal				
Minimum	33-38	35	32-38	35
Maximum	50-100	67	45-70	52
Flash point, deg. F.	-	150	-	150
Cetane no., minimum	45-46	45	35-50	48
Sulphur, weight, per cent, max.	0.5-2.0	0.85	0.10-1.50	0.51
Distillation, deg. F., 90 per cent point, maximum	625-690	665	540-675	632
End point, maximum	675-700	690	650-700	675

performance, but we are on the way toward finding out. Some of the fuels that have been tested or are soon to be tested are shown in Table IV.

It will be noted that our first series involves a group of fuels which flash at 125 deg. F., since by this route it is possible to extend supplies with the least degredation in cetane number and sulphur content. This method holds promise because of the interdependence of kerosene and high quality Diesel fuels. Both generally come from the same type of crude but they cannot be cut at the same time since kerosene is lighter and Diesel fuel heavier, while both have a common center fraction. The kerosene is the coat and vest; the present Diesel fuel the vest and pants. The 125 flash fuel is the coat, vest and pants and results in larger coverage for Diesel fuel supplies.

Table IV—High-Speed Diesel Fuels, Inspection Data

Inspection	Conventional High-speed fuel	Wide cut fuels: High cet. no., Low sulphur	Wide cut fuels: Low cet. no., low sulphur	Wide cut fuels: low cet. no., high sulphur
Viscosity at 100 deg. F., Seconds				
Saybolt Universal	35.2	33.4	35.5	35.5
Flash pt. deg. F.	165	125	125	125
Cetane no.	53	53	45	45
Sulphur, wt., per cent	0.2	0.1	0.2	1.0*
Distillation, deg. F.				
Initial point	350	310	310	310
50 per cent point	510	485	500	500
90 per cent point	585	590	600	600
End point	640	630	650	650
Heating value, B.t.u. per gal.				
High	137,410	135,910	139,000	139,000
Low	128,830	127,450	131,000	131,000

*Maximum

If the limit in cetane number has not been reached after testing these fuels, lower cetane fuels will be tested and these data will be discussed with the engine manufacturers and the railroads, for only by cooperation can generally acceptable compromises be arrived at for the mutual benefit of the petroleum and railroad people.

Please do not get the impression that the petroleum industry foresees a definite shortage, for that is not the case. We do not dismiss the possibility since so many unseen new demands for energy might arise. The best available information for the immediate future is summarized below:

Demand and Supply, 1946 to 1948

Domestic demand for petroleum in the United States in 1946 exceeded 1945, the peak war year, and total demand, which includes exports, was only slightly below the 1945 level. Domestic demand continued to gain and by 1947 it alone was sufficient to exceed the total demand for the year 1945. The tremendous increase in domestic requirements was the result of heavy highway traffic, a high level of industrial activity, increasing use of oil for home heating and greater use of Diesel fuels.

The requirements in 1946 were supplied without any great difficulty and inventories were partially restored. In 1947 there was more than 10 per cent gain in total demand and the industry had to push all of its facilities to their utmost to cope with the situation. As a whole deliveries were almost sufficient to meet all requirements; nothing more than minor inconvenience resulted.

In mid-1947 the midwest area was the most critical in the country, with product inventories below desirable levels. Extensive movements of crude and products from other districts, and an increase in refinery runs gradually alleviated this condition.

In the meantime the east coast situation continued to worsen. The shortage of crude at east coast refineries caused a decrease in refinery output, and some products moved from the Gulf to the midwest that might otherwise have been available to the East Coast if tankers had been more available. As a result of the tight supply situation and abnormal weather conditions, there were occasions this past winter when some heating oil consumers were without supplies for a day or two, but at no time was the industry short as a whole.

For the year 1948, the latest estimates of the Bureau of Mines show a gain in total demand of about 6 per cent over the record 1947 level. Crude-oil production is expected to show a substantial increase over 1947, and with some gain in natural gasoline production and imports the total supply is estimated to be about 8 per cent greater than last year. The realization of these supply and demand estimates would allow for a stock build-up of about 100,000 barrels a day and would indicate some easing in the situation unless unforeseen military requirements develop.

The balance between supply and demand is a fine one and may continue to be for the next two or three years. Accordingly, every barrel which can be saved is important. Relief of unnecessarily restrictive specifications will help the Diesel fuel situation appreciably in this respect, and so will the avoidance of diversion of high-quality Diesel fuels to heating purposes where coal will do just as well. Also, the fuel oil consumed in oil-fired steam locomotives is 270,000 barrels a day which is almost as large as the volume of Diesel fuel required to power all the railroads if completely converted to Diesel. The economics of the oil-burning locomotives might be looked into to see whether it would not be economical to back these out first as Diesels come in.

Discussion

In answer to a question as to whether the petroleum industry would be able to cope with the continued conversion to Diesel motive power to the point where steam would be eliminated, Dr. Sweeney said that, under normal conditions, he felt that with the economies that appear atttainable by the railroads using Diesel fuel, it would be feasible to supply them. Dr. Sweeney reminded the audience that it is within bounds to convert coal into oil and that, despite the loss of 50 per cent of the heating value in the conversion process, it would be almost as economical to use the synthetic oil. The difficulty, he said, is that the conversion process will take a tremendous amount of steel.

C. E. Smith, (New York, New Haven & Hartford) referred to figures which indicate that if all of the oil-burning steam locomotives in the United States were replaced with Diesel locomotives, the reduced amount of liquid fuel required would be sufficient to replace the coal-burning locomotives. About 270,000 barrels of oil a day are now used on oil-burning steam locomotives, he said, most of which is of the residual class, and 56,000 barrels of Diesel fuel a day are being consumed by the railroads, a total of both classes of 326,000 barrels a day. To run all the railroads with Diesel oil would, he said, require about 300,000 barrels of Diesel fuel a day.

The Question of National Defense

During the discussion Brig. Gen. P. F. Yount questioned Dr. Sweeney as to what the oil industry thinks the impact of the expansion in the use of jet engines in aircraft would be on the availability of Diesel fuel for locomotives, and the following exchange took place:

General, if I knew what the requirement for jet fuels was going to be, I guess I wouldn't tell anybody,

and that just about leaves me in a position to say what everybody knows, namely that jet fuel will definitely compete with Diesel fuel. After all, the jet-fuel specification is gasoline plus everything above it which you can get that will still meet the freezing point, and some of that stuff would go into Diesel fuel. I have seen rumors in the press that the jet-fuel requirement is going to be big. If it is going to be really big, obviously it is not only going to cut into Diesel fuel, but it is going to cut into gasoline and fuel oil and almost into lubricants and other petroleum products. If there is a really big demand for jet fuel—for instance, half a million or more barrels per day—you cannot get it except from somebody else, and Diesel will be one of the sources. On the other hand, when you look at these figures of seven times as much work per B.t.u. in the use of Diesel fuel on the railroads as compared with coal, certainly, energy-wise and overall, the Diesel for railroads has a pretty good margin in any tight situation.

General Yount: If our experience in the use of petroleum products means anything, the increase in the consumption between World War I and World War II was something on the order of 5,000 per cent, and while I do not think that anybody can forecast that percentage in the future, certainly without knowing when we might be in another national emergency, I think we may expect a very, very greatly increased consumption of petroleum products in any future national emergency. Even if that were to come today, the demand for petroleum products would probably be double that of World War II, in the light of present mechanization, and the whole trend in equipment has been one toward increased mechanization. As we go progressively forward in the years we may certainly expect a very great increase in such demands. I regret that I have forgot the exact consumption of the armed forces, but my best recollection is that it was on the order of one and one-half million barrels a day at the very peak of the war.

Dr. Sweeney: No doubt about that. Aviation alone was almost 600,000.

General Yount: Supposing that we assume now that, in the very near future, that were doubled, in which event we would place upon the oil industry a demand for three million barrels per day for the operation of the armed forces. Then we go into your proved reserves and, with an increasing ratio like this, it would work out in this way: With our consumption at something in excess of eight million barrels a day as against the 22 billion barrels in proved reserves, they would be used up in about six years. At present we are depending on a great deal of imports and, of course, we have a certain amount of exports as well, which is a counterbalancing factor, but we have no way of assuring ourselves that we may continue imports, and if we have any friends at that point we certainly would face the danger of having greater export requirements.

Dr. Sweeney: If you are going to double the petroleum requirements in a war you are going to need steel and other things, and that is going to be a tough job.

General Yount: That is the danger. The competitive position of steel is one of the most critical factors in the discussion.

The Outlook of Coal for Railroad Fuel*

By Earl C. Payne

The immediate and near future of coal for locomotive fuel is dependent upon the continued use of steam motive power. The newspapers have recently carried a brief mention of the report that the three large builders of steam locomotives have submitted to the secretary of National Defense and the Association of American Railroads. These builders have asked for a declaration of policy concerning the future purchases of steam motive power because, during this Diesel buying spree, they have had practically no steam locomotive business. These three companies have approximately $35,000,000 invested in facilities to build steam locomotives and cannot maintain this equipment and hold together the necessary manufacturing and engineering organization if the present trend continues. The coal industry is also interested in this decision. A severe decline in the use of steam locomotives will require some future sales plans for the locomotive fuel being displaced. The rapid growth of the utility business will absorb much of the lost locomotive fuel, but if steam locomotives must carry the major transportation burden of this country in peace and in future wars, then the coal industry should provide facilities to supply the quality and preparation that is best suited for their use.

If the railroads and the government are unwilling to place orders now for new steam power, the builders should be told what they can expect. In any case, reasonably modern locomotives under 20 years old should not be scrapped because they will be needed, and fast, if we get into a war.

In my opinion, the bulk of the freight traffic will stay with coal for many years. Several factors seem to justify this conclusion. The petroleum industry is just beginning to publicize its problems in meeting the demands of this country for gasoline and the distillates used for domestic heating and Diesel engines. The known reserves show a precarious margin when compared with the accelerating demand for liquid fuel. Some of the oil companies have advertised and stated publicly that the solid-fuel industry should take over the "burden" of heating American homes, and every industry and utility now using distillate and residual oils are being warned that future supplies for space heating and steam generation will be limited and that conversions should be made back to solid fuel.

This reserve supply and production situation of petroleum is further emphasized by the government's proposal to sponsor a nine-billion-dollar synthetic-fuel industry which is supposed to prevent a shortage of liquid fuel, particularly in case of a national emergency. If such an emergency is not imminent, then it should be recognized that natural economic factors will eventually force the growth of a synthetic-fuel industry as soon as commercial processes are perfected and as soon as the synthetic products can be manufactured and sold in a competitive market.

One of the best ways to make available natural petroleum for these specialty uses in which solid fuel is entirely unsuitable is to stop the use of oil for such ordinary applications as space heating and steam generation—places where coal, with modern equipment, can be used with equal convenience and efficiency. Keep in mind

that when coal and natural gas are converted to synthetic liquid fuel, over half of the heat value of the natural product is lost in the process. Also, this wasteful sacrifice in energy reserve to make oil from coal or natural gas can only be accomplished at a fabulous cost which, today, must be largely taxpayers' dollars. These conversion facilities will require a tremendous tonnage of badly needed steel. (12 to 14 tons per barrel of capacity as compared to ¾ ton per barrel for natural petroleum refineries). It, therefore, seems of immediate importance that the billions of gallons of oil that are now being unwisely used, particularly for the generation of steam and heating by industry, be diverted into fuel channels in which natural coal will probably never be an acceptable substitute.

The Effect of Diesels on Coal Demand

The Interstate Commerce Commission reports show that the eastern carries in 1947 used approximately 50 million tons of coal and Diesel oil equivalent to about 7.2 million tons. The two big carriers in this group used about 25.9 million tons of coal, and Diesel oil equivalent to 1.6 million tons. The Dieselization program already announced by these two roads will probably displace another 4.5 million tons of coal. In classes of service the eastern carriers use Diesels for 25.2 per cent of the total freight switching hours, 10 per cent of the gross ton miles of freight were hauled by Diesels, and 20.7 per cent of the passenger-train car-miles were with Diesels. If we take a pessimistic average of an eventual one-third Dieselization of these eastern roads, approximately 18 million tons of coal business based on present traffic levels may be lost. Unfortunately when the time comes that current traffic levels are reduced, the steam locomotives which now average more than 20 years of age will be taken out of service and the newer Diesel locomotives will be used, assuming, of course, that adequate distillate fractions of petroleum are then available to carry all of the country's transportation needs in the military, civilian, and domestic heating fields.

Information has reached me from several eastern railroad men who are in a position to know that their companies have about completed their Dieselization programs. The rapidly accelerating price of Diesel oil and the short supply situation already noticeable is evidently changing the competitive position of modern steam and modern Diesel locomotives, or at least to "Stop, Look and Listen."

The Smoke Problem

The public clamor for elimination of smoke and fly ash has undoubtedly been a major factor in the purchase of Diesel power. It is unfortunate that the representatives of the people in government have not been advised of the economic consequences of forcing conversions to oil simply to eliminate coal smoke and fly ash. This nuisance has been with us for more than a century and its immediate abolition should not be forced by stringent laws without regard to the full impact on the supply of heating oils which that same public uses. An educational program should bring the facts from impartial sources to lawmakers and their constituents. It is my firm belief that a well-informed people will not be unreasonable in their smoke demands if they are confident that the immediate abolition of all coal smoke is not in their best interests.

The railroads and the bituminous coal industry are now actively engaged in test programs and research which have as their major objective the correction of this smoke nuisance on conventional coal-fired steam locomotives. As chairman of the Motive-Power Committee of Bituminous Coal Research, Inc., I am confident that in a few short years we will know how this can be accomplished. The job has been done on the coal-fired switching engines and intensive work is under way on eliminating smoke on the hard-working road locomotives. Possibly our efforts have been a little late in getting started, but certainly the job could not have been done during the war. You may be sure, however, that it will be done as quickly as the technical and research engineers of these two great industries can find the answer.

Prepared Coal

For several years your speaker has been recommending the use of a better quality, well-prepared double-screened coals for road locomotives instead of the run-of-mine coal which the railroads have always used. Quite recently many test-plant investigations have been made, road tests have been conducted, and comparisons have been made with groups of locomotives in commercial operation to obtain data on the increased value of egg coal. A major change in locomotive fuel size and quality is necessarily a long-range program because the coal industry must build new tipple facilities and revise their sales distribution in order to supply this type of coal for locomotive use. It also takes a bit of proof (to put it mildly) to convince the railroads that they are justified in paying a higher price for a better coal.

It gives me pleasure to report substantial success in this changeover to the use of double-screened coal. Eight of the eastern railroads are now using double-screened coal on their road locomotives and several of them have decided to buy every ton of it they can get in the present market. These roads now using egg coal have factual information showing improvement in the range of from 6 to 20 per cent in better evaporation, higher capacity, and improved boiler efficiency. These bare facts show more than enough to pay the additional cost of egg coal for both on-line and off-line railroads. In addition to these tangible facts, there are many intangible benefits which are in my opinion of greater value in reducing the over-all cost of operating steam locomotives. Better quality and better preparation improves smoke performance, reduces stack emission, reduces maintenance, increases reliability, and improves availability. These intangible factors, in which the steam locomotive has been deficient in its competition with the Diesel locomotive, have also in some measure been responsible for the Diesel preference when purchasing new motive power. Better coal on a modern steam locomotive will give a cost and a performance that is quite comparable with the best Diesel locomotives available. Therefore, if better locomotive fuel is used by the railroads, then the outlook for coal is good. If they continue the purchase of unsuitable coal, the outlook is not at all promising.

A Fact-Finding Committee

The New York Railroad Club is composed of men who are directly or indirectly interested in the future of the railroad industry. You also have a responsibility to the public because you understand and can analyze factual information concerning railway operation when made available. It would be my suggestion that you form a fuel resources and fuel uses committee to get up the facts and study this problem of fuel supply and demand, and then make your own conclusions. If you believe, after you know all of the facts, that the steam locomotive is obsolete, say so; and if you believe that coal should be retained as the major supply source for conventional locomotives or for new coal-fired locomotives to be developed, then say that also, with your

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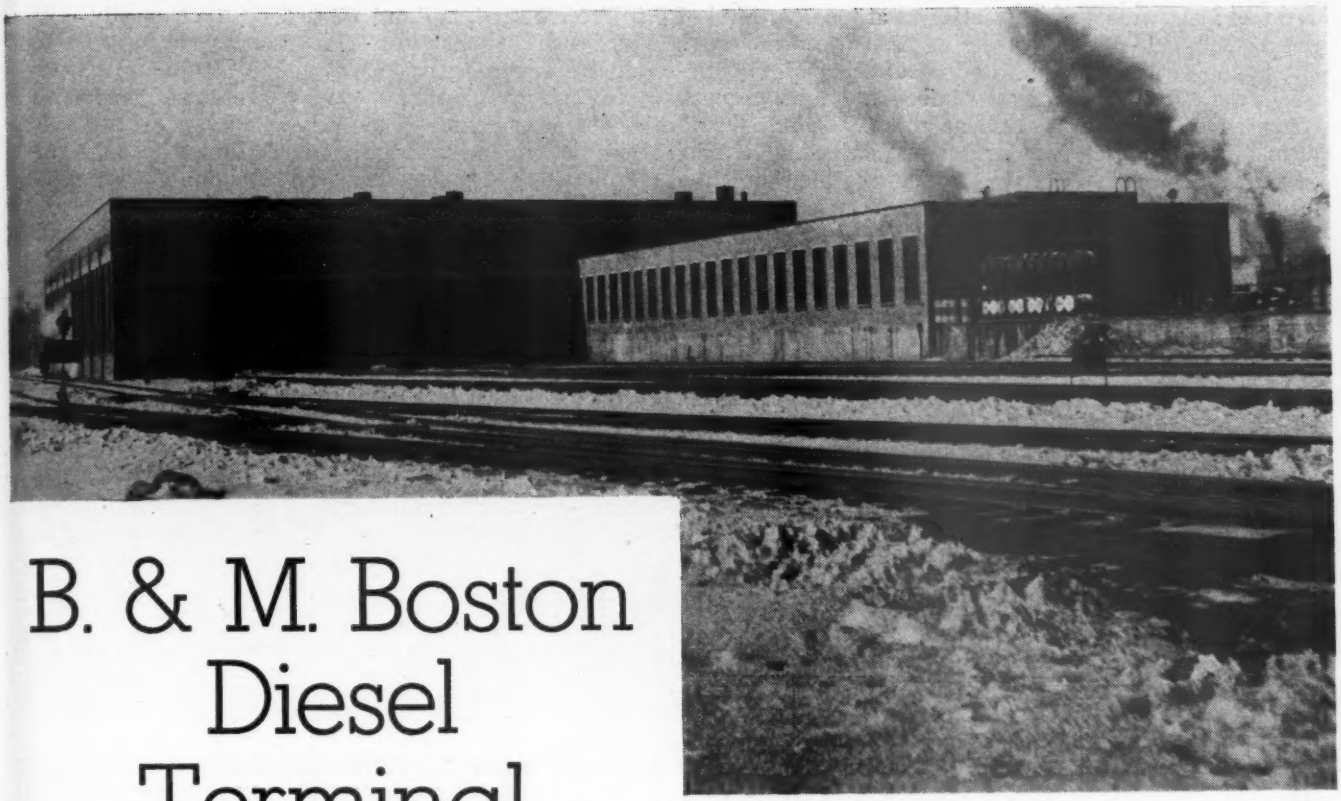


B. & M. Boston Diesel Terminal

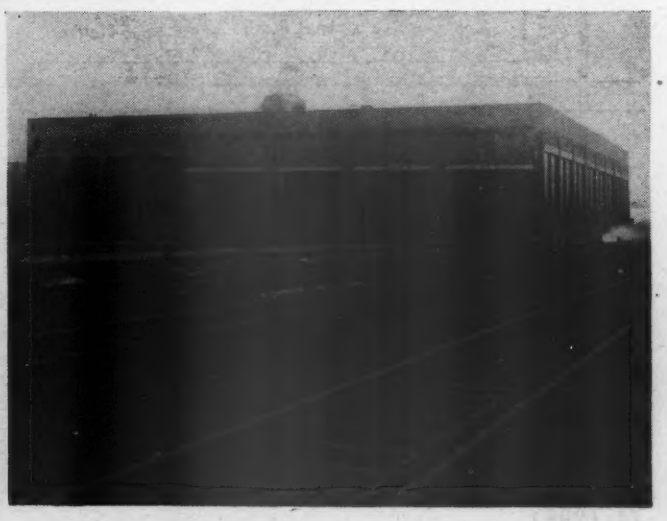
Plant for servicing passenger and switching locomotives includes a storehouse and a tank for storing 100,000 gal. of fuel

THE new Boston & Maine terminal for the servicing of Diesel-Electric locomotives at Boston, Mass., known as the Boston Diesel Terminal went into service in January.

The new terminal is designed for the servicing of passenger locomotives and switchers assigned to Boston and takes care of both running and progressive maintenance. It also serves as a turn-around terminal handling the running maintenance on freight locomotives which are turned at Boston. The freight power is maintained at the Mechanicville, N. Y., shop. The mechanical and engineering departments of the railroad cooperated in the design of the terminal facilities which embody the latest conveniences as to lighting, ventilation, safety, cleanliness and working equipment.

The general system of handling the running and progressive maintenance of passenger and switching locomotives at the Boston Diesel Terminal is in accordance with the system developed by the Electro-Motive Division of General Motors Corporation and is used on many railroads using that type of power. Certain variations in this system have, however, been made on the Boston & Maine to adapt details of the system to conditions peculiar to its operation.

The main shop building has four parallel service tracks,



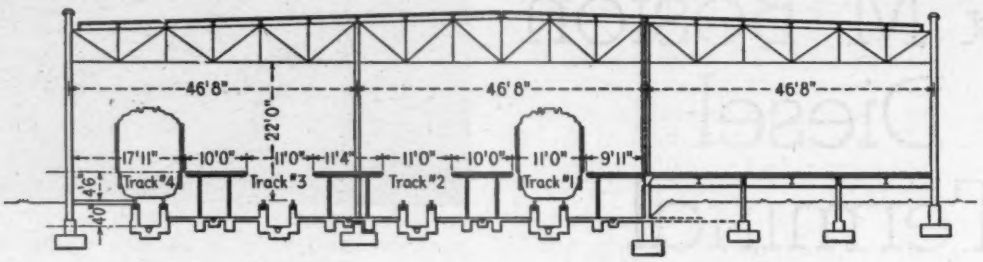
Left: The outside fueling platforms have drains for excess oil which is carried to a separate draining system—Right: The west side of the shop showing fueling location at the inbound tracks

176 feet long, with working platforms at the floor level of the locomotive along both sides of each track and work space along each track pit for the servicing of the running gear. The shop structure embodies glass brick wall construction providing excellent natural light to supplement the general lighting scheme, which is largely of the fluorescent type. Along one side of the shop, on a level with the raised platform, are the various service rooms where parts are cleaned and handled together with offices and storeroom space. The second floor above the office space has a spacious locker-room with over 200 lockers, as well as fountain-type automatic washers, showers and toilet facilities.

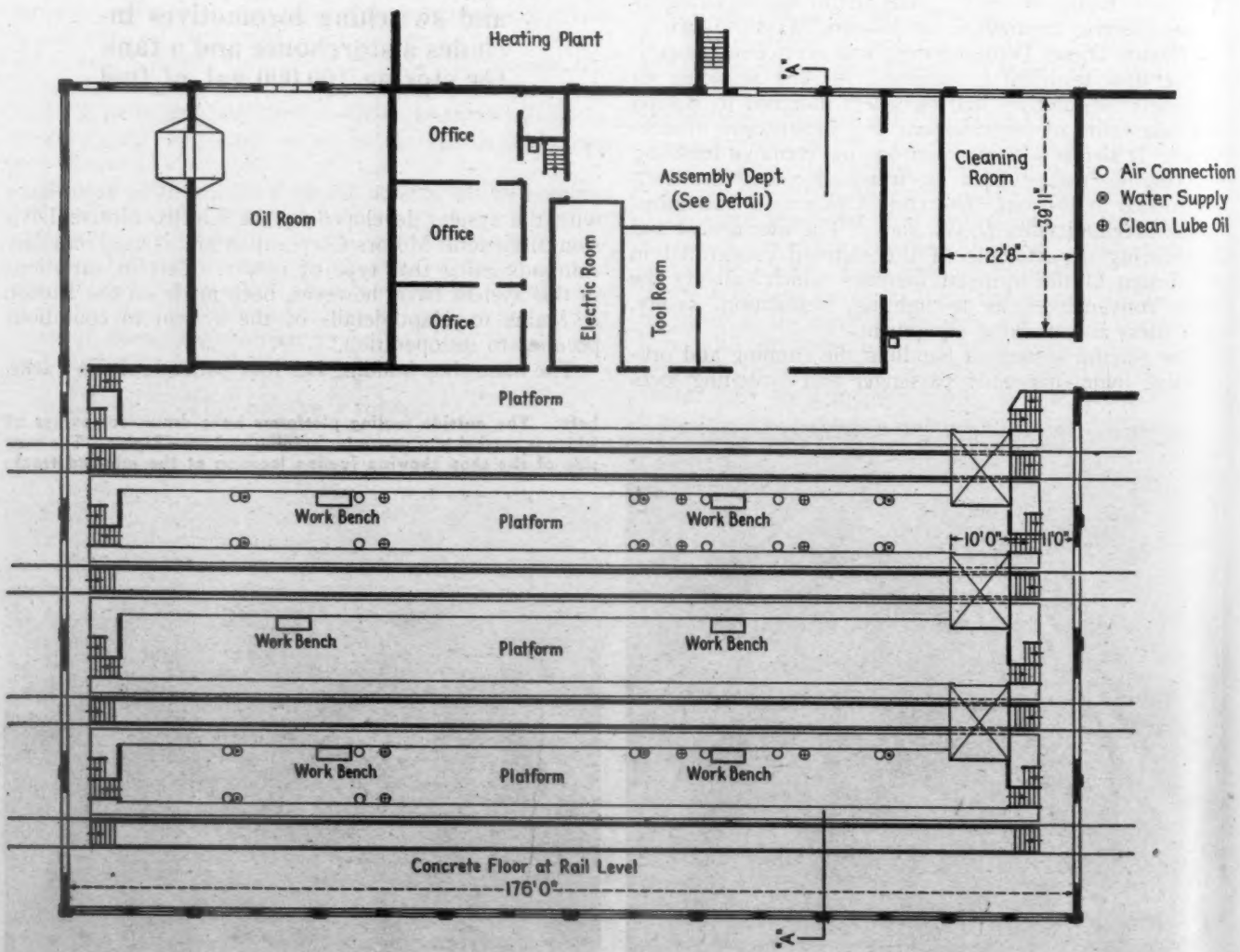
The layout of the main shop is such that operations will flow from west to east with assembly line precision. Diesels arriving for service are left on the fuel tracks at the west end of the shop by incoming crews. After being fueled by pumps with a capacity of 75 gallons a minute, the locomotives are moved into the shop for servicing. After servicing, they move out the east end, to receive sand, and are washed by mechanically revolving brushes similar to machines already in use for washing passenger cars. Then they move to the nearby turntable and are placed on waiting racks ready for service.

The new terminal has several features of novel or improved type compared with facilities of the first Diesel terminal at Mechanicville. The structure, with the exception of the offices, is heated by a forced warm air system, from oil-fired heaters, thermostatically controlled to assure comfortable conditions in any weather. The offices have an independent heating unit, also controlled thermostatically. Both systems draw in fresh outside air and thus will permit of air cooling in warm weather.

Just inside the east-end doors are lift bridges that join the raised working platforms across the tracks. These are of steel and are operated by push-button-type electric hoists, in contrast with the hand operated hoists which lift wooden platform bridges at the Mechanicville shop. Another novel feature is a series of indicator lights at the east end of each track, which gave an automatic red



Plan and typical transverse sections of the Boston Diesel Terminal shop

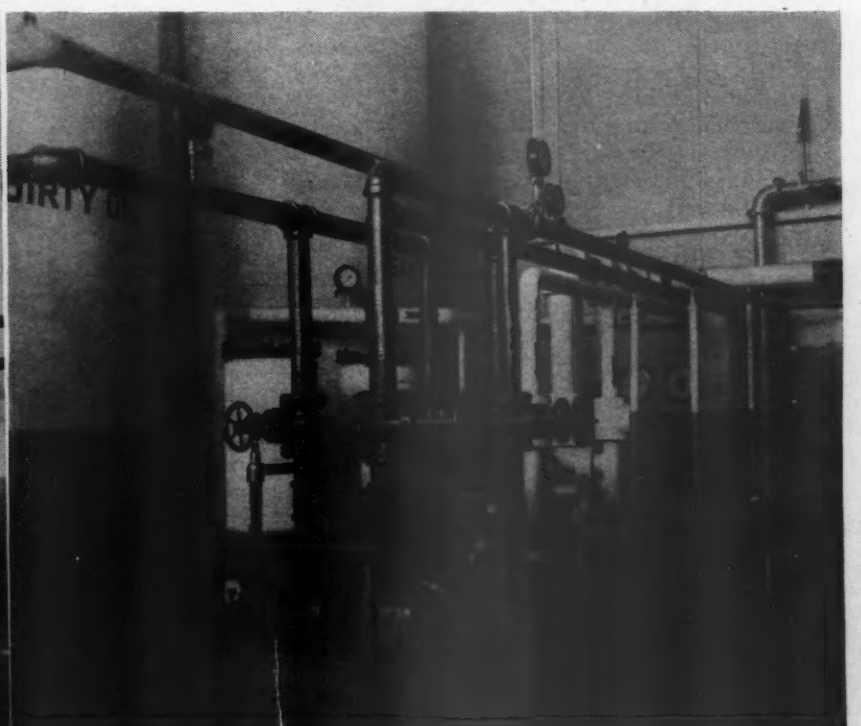


Left: The arrangement of pits, platforms, heaters, lighting and ventilators is shown here—Right: The platform drawbridges provide continuous platforms when lowered

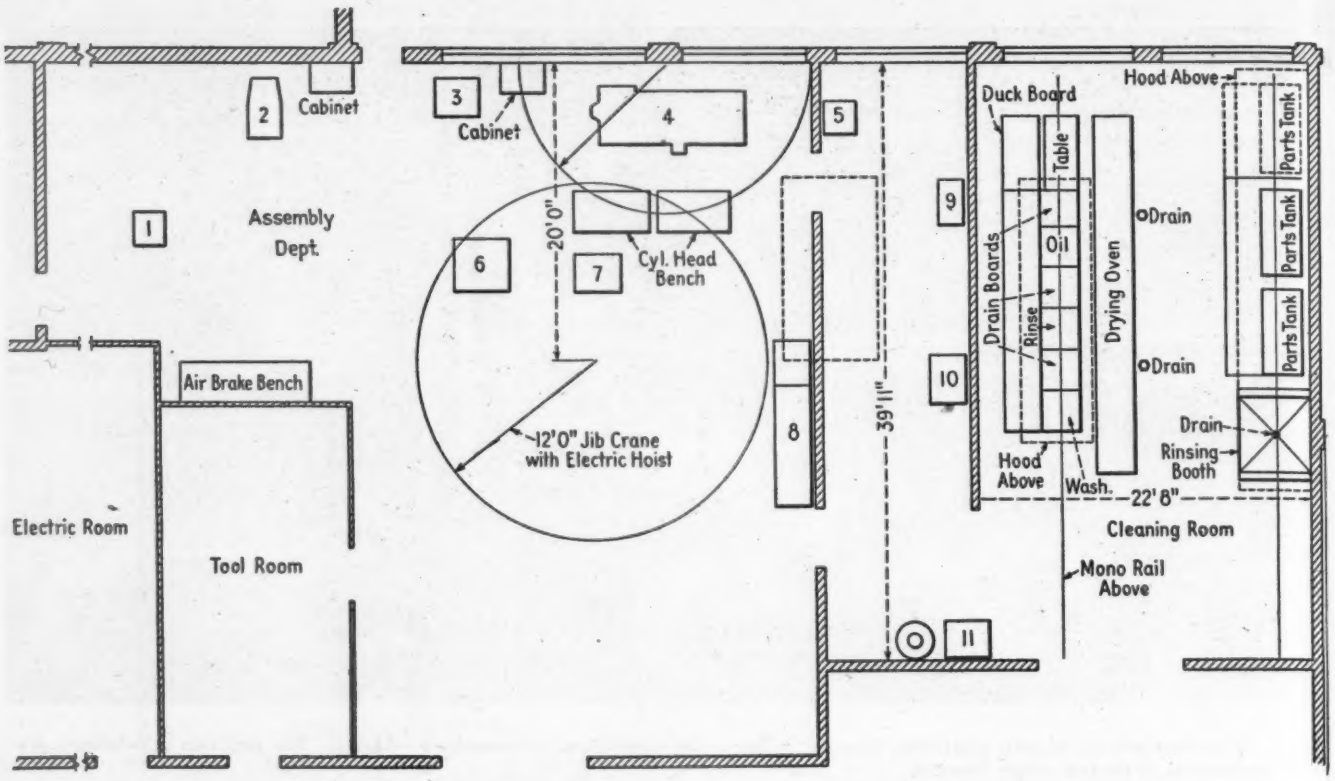
warning when the lift bridges are across the tracks; a green when the track is clear.

A distinct improvement over earlier Diesel terminals is a special heating arrangement which projects forced hot air into the track pits for de-icing the running gear. The shop has a department for cleaning filters and engine parts, and a department for repairing and assembling intricate engine parts. In place of a distilling plant for cooling water, this terminal has a demineralizing plant which eliminates minerals from city water and treats it with a chemical compound. It is piped directly to the locomotives and city water is used for locomotive storage batteries, whereas at Mechanicville distilled water has to be used for batteries.

Each working platform has work benches, tools and equipment at intervals spaced to allow for ready accessibility, and outlet pumps for providing lubricating oil and cooling water, likewise spaced for efficient servicing. There is an overhead monorail hoist, of ½-ton capacity, for handling heavy equipment. The assembly department is equipped with two smaller hoists. There is no drop pit for the removal of motors and wheels as such heavy



Left: 2,000-gal. tank and related equipment for demineralizing system used to supply water for storage batteries and engine cooling systems;—Right: A portion of the mechanical equipment for the lubricating-oil circulating system. Storage tanks for clean and dirty oil are 15,000-gal. capacity



1—Piston and connecting-rod assembly jig
2—Vertical drill
3—Valve grinder
4—20-in. by 48-in. machine lathe
5—Floor grinder
6—Hydraulic press
7—Cylinder-head positioner
8—Magnaflux testing machine
9—Honing machine
10—Cylinder-head positioner
11—Filter-cleaning equipment

Location of equipment in the Boston Diesel Terminal assembly department and cleaning room

work is handled at North Billerica, Mass., shops. In event of emergency drop pits in the adjacent steam engine terminal can be used for removing motors and wheels.

Above the four service tracks are 25 steel ventilators, with electric exhaust fans enabling each ventilator to exhaust locomotive fumes at the rate of 5,000 cubic feet a minute. These are painted with a high temperature paint in order to blend with the modern application of color dynamics throughout the shop, a color scheme specially engineered to provide the maximum of light and restfulness for the eyes of employees.

The major colors are a light cascade blue on sidewalls and ceilings and sun-tone yellow on the end walls.

The terminal is designed to provide the utmost in safe working conditions. In addition to its brick and steel exterior construction the building has tile walls inside and concrete floors and platforms. Beside the track doors at both ends of the main shop are reels of "wet fire hose," meaning hose with water already at the nozzle. On each working platform are two 20-lb. carbon-dioxide fire extinguishers and overhead is a sprinkler system on which the pressure can be maintained at 120 lb. by a booster pump.

The cleaning department and the outside fuel oil platforms have drains to catch any excess of oil and to prevent it from flowing into the regular drainage system to pollute the harbor water nearby. The oil room in the shop has a 15,000 gallon lubricating oil tank and is further equipped with a 15,000 gallon tank for storage of dirty oil, drained from locomotives. The dirty oil will be returned to the refinery for reclaiming.

The storeroom, at the northeast corner of the shop, has a spacious delivery platform, served by a sidetrack, with a ramp at one end to provide for truck delivery also. To the east of the main shop is a small brick pumping station, housing three 300-gallon-per-minute pumps for unloading fuel oil from tank cars to the 100,000 gallon storage tank and for pumping it from storage to the dispensing pumps. It also houses two 50-g.p.m. pumps for unloading bunker oil, used for heating purposes, and for pumping it from storage tank to the oil burners.

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Tank cars waiting to be cleaned at the Wood River, Ill., refinery of the Shell Oil Company where a shop for the complete repair and reconditioning of company-owned cars has been established

B. & O. Wheel Shop

(*Continued from page* 63)

Wheels requiring truing of journals are rolled directly to this lathe on a track and handled in and out of the machine by a three-ton tramrail electric hoist. This lathe is tooled with high-speed O.K. and Apex tools. The output is 17 pairs of wheels in eight hours, both ends of each pair being machined and burnished.

Turning Steel Wheels

The wheel lathe is a Sellers Standard 50-in., type RB, with two compound tool slides, each equipped with a Sellers smooth-finish tool holder taking four tools, and with hardened steel inserts under fixed forming tools. The wheel lathe operates at a cutting speed of 17 ft. per minute. The output is 11 pairs of wheels per eight hours. Gorham insert roughing and forming tools are used on this operation.

Will It Be Coal or Oil

(*Continued from page* 72)

words of caution. Major differences of opinion usually occur when insufficient factual information is available and that is why the fact-finding committee is recommended. This paper has made no attempt to present a mass of facts and statistical information on this subject, which is in my possession. You would have more confidence in the facts developed by your own committee.

You may judge from my remarks on the future of coal for locomotive fuel that I have confidence in the continued use of coal in its natural state for railroad motive power. The economic evolution of railroad motive power is toward electrification, not Dieselization. Few of us in this room will ever see atomic power locomotives, but most of us will see *coal* being used directly by steam or gas-turbine locomotives, or indirectly by electric locomotives using coal-made power, for coal—like it or not—is the only foreseeable energy source for railroad motive power.

Discussion

In answer to a question as to how many years it would take to work out a supply of sized coal for the railroads, Mr. Payne said that all sized coal now produced is sold and that one difficulty is that the railroads will take sized coal one month and then not take any the next month. They have not, he said, standardized on such coal at the premium price which they have to pay.

In answer to the question as to the cost of sized coal compared to run-of-mine, Mr. Payne said that in the case of the high-volatile coals from Districts Nos. 1, 2, 3, and 4 from which the eastern roads get most of their coal, the price differential is usually about 5 to 6 per cent above the mine-run price; that is, from 25 to 35 cents, possibly 50 cents, a ton higher. It is easy, he said, to justify a differential of 10 per cent by the better performance. He cited a case in which tests showed that 95 lb. of run-of-mine coal and 66 lb. of sized coal were burned per 1,000 gross ton-miles. A test between locomotives fired with mine-run coal and doubled-screened coal, he said, showed that it was possible to run between origin and terminal day in and day out without a smoke violation from the double-screened coal, where they had been unable to run in either direction without a violation when burning mine-run coal.

Questioned as to what the mines would do with the slack accumulating from the production of double-screened coal, he cited one district which in the past six years has developed a new business in the utility and industrial field for 32 million tons of slack coal—more than the district produces.

* * *

This 115-ton, 1,000-hp. Diesel-electric switching locomotive is the first of a fleet of 20 under construction at the Montreal Locomotive Works for the Canadian Pacific. It was on exhibit at Toronto, Ont., at the Canadian International Trade Fair from May 31 to June 12. The remaining locomotives are scheduled for completion this year

EDITORIALS

Don't Overlook The Automatic Machine

Except in the largest railroad shops where a substantial volume of repetitive work was required day after day, it has never been considered feasible to install any great number of automatic machine tools. This is no longer true. Three things have happened to change the situation. Labor has demanded and secured higher and higher wage rates; shortened the working week, and slowed up the job so that production per man has been reduced considerably as compared with the period before the war. These three factors have resulted in greatly increased production costs, in itself a serious matter, and have operated to reduce the production of car and locomotive parts when higher traffic rates are wearing out equipment more rapidly.

That this is so in the railroad industry is due to a rather short-sighted policy with respect to the replacement of shop machinery and tools which is in evidence in the majority of shops by merely making an analysis of the age of the machine tools and the fitness for service under modern conditions. The average age is extremely high—somewhere in the neighborhood of 70 per cent over 30 years old.

Shortly after the end of the war, in 1945, it began to look as though the roads were going to do a job in shop rehabilitation for they went into the market with substantial purchases and developed elaborate long-time programs. Except in the case of a few of the more progressive roads, most of these programs have never been completed.

This discussion was introduced by mention of automatic machinery and its lack of suitability to railroad work. It was suggested that changed conditions have altered the relationship of automatic machinery to railroad production. The automatic machine, in the older days, was the tool in which motions were developed and controlled purely by mechanical means —cams, rollers, arms and rods—but the progress in hydraulics and electronics over the past ten years has made available an entire new category of automatic machinery which is "made-to-order" for railroad work because it can handle the machining, such as boring, turning, facing and milling of parts of almost any size required in locomotive or car work.

An interesting advantage of this new automatic machinery is that its set-up time is so low and its capacity so large that on a run of as few as 15 to 25 large parts the set-up time is a small part of the total production time. An example is a boring mill on 40-in. Diesel locomotive wheels where by the old manual method three hours were required to do the job that is now done in one hour. On a run of 25 wheels the job is now finished in four eight-hour shifts with a set-up time of five hours. The old method, on a modern manually controlled machine, required 12 eight-hour shifts.

The new automatic machine tools will not only produce from three to six times as fast, depending on the job, but have one outstanding advantage: once the set-up is made no operator can stall on the job or change the production time. It's fixed and the only way to lengthen the floor-to-floor time is to shut down the machine completely.

Regardless of any former consideration, these new automatic machine tools now have a definite place in the railroad field and if the proper study is given to their potentialities, it will become obvious that it costs a railroad real money to be without them.

Fuel Economics

On another page in this issue is the report of the papers presented by Dr. W. J. Sweeney, vice-president, Standard Oil Development Company, and Earl C. Payne, consulting engineer, Pittsburgh Consolidation Coal Company, at the April meeting of the New York Railroad Club. These give the views of the two fuel-producing agencies with respect to the railway fuel of the future. For the first six months of 1945 and 1946, Dr. Sweeney shows the heat consumption in B.t.u. of steam locomotives to have been thirteen times that of Diesel locomotives per switching locomotive hour during both six months' periods; 6.7 times in 1945 and 7.4 times in 1946 per ton-mile in freight service, and 5.8 times in 1945 and 6.0 times in 1946 per car-mile in passenger service.

While an assumption as to the average heating value of the coal and the Diesel fuel is required for the calculation of these figures, they probably represent substantially the facts for a comparison of Diesel locomotive performance and overall steam locomotive performance in each of the three services. But general conclusions drawn from these figures as to the results to be obtained from complete Dieselization in comparison with the results which could be obtained with steam—and with even less capital expenditure—are bound to be misleading for three major reasons.

First, Diesel locomotives, particularly in road service, are assigned to runs where conditions are most favorable for economical fuel performance. The average performance of steam locomotives is influenced by all the branch-lines and local service which operates under conditions exceedingly unfavorable to economical fuel performance.

Second, from the standpoint of fuel economy, Diesel locomotives are all modern, while the steam locomotive inventory contains a large number of locomotives twenty or more years old.

Third, steam locomotive service has long been hampered by the traditional practice of supplying steam locomotives with run-of-mine coal, frequently of a quality scarcely marketable for any other purpose. Mr. Payne, in his paper, points out the proved advantages of double-screened coal in fuel economy which more than justify the usual price differential for coal of this quality.

While specific cases may differ in relative fuel costs because of relative prices, it seems probable that the adoption of Diesel locomotives cannot generally be justified on the basis of fuel costs.

Shop Engineering At It's Best

Those attending the May meeting of the Eastern Car Foreman's Asociation had the privilege of hearing about one of the finest shop facilities on any railroad in the country when they listened to F. B. Rykoskey, supervisor of shops, Baltimore & Ohio, describe the operation of that road's Glenwood wheel shop. In addition, a motion picture gave them a better understanding of how the application of sound shop-engineering principles cut the man-hours per pair of wheels to less than 50 per cent of the man-hours required in the wheel shops abandoned after this centralized shop went into production. There are, however, two phases of shop engineering as practiced by Mr. Rykoskey that are not directly associated with shop production but which are nevertheless essential to the success of any shop-practice department. One is the job of justifying to railroad management the investment required to make improvements in shop methods, equipment and tools. The second is the necessity of periodically checking the cost of a shop's operation to make sure that its known production capacity is being utilized.

The railroad managements want to know why a new shop or piece of shop equipment is needed, how much it is going to cost, and what savings will be effected. Therefore, arguments for a new shop or new equipment should be backed up with cost data of the before-and-after kind. In telling about his approach to the problem Mr. Rykoskey said, "It is our practice, before recommending any improvement in facilities or practices, to make a cost study of the elements involved in the operations concerned. In our wheel-shop study the man-hours required were determined for every operation, as well as the handling of wheels and axles from the time that they are brought into the wheel shop until they are taken out, either as finished mounted wheels or scrapped. This study was the basis for estimated savings which would justify the investment in this project."

Although not mentioned by Mr. Rykoskey in his discussion of the Glenwood wheel shop and wheel-shop practices, his department has determined that a periodic follow-up of improvements in facilities and practices is an essential part of the department's work. Furthermore, it is a requirement for keeping a shop's performance at the productive level of which it is capable.

As an example, his department maintains a chart which shows graphically the weekly production costs at the Glenwood wheel shop. If the curve of the costs starts going up, his department makes an investigation to determine the reason and takes corrective action if the increase is due to a factor that can be controlled. Recently the costs for this shop started rising and the investigation developed that the production had dropped off because the supply of wheels and axles at the shop was insufficient to maintain the shop output at the economical production rate. The situation was corrected by contacting the stores department and getting wheels and axles moving in a hurry to the shop and by closing down one of the older shops.

These two shop engineering functions are more than just essential to the success of a shop-engineering department. A cost study by the mechanical department is the best way to get across to management the need for the improvements that must be made if this department's work is to be placed on an efficient basis and the mounting labor costs are to be kept within the bounds of limited budgets. The follow-up of the utilization of improved facilities is the only way that the potential economies of these facilities can be realized.

Cost of Train Power

Since axle-driven generators were first used to supply power for lighting passenger cars, attempts have been made to determine the cost of such power. Dynamometer cars were used in attempts to measure the total power requirement from the locomotive, but early generators were small and it was discovered that a side, or quartering, wind would produce more load than the generators and it was not possible to separate the effect of one from the other. After a time, the matter was allowed to lapse and nearly everyone accepted the summation, "You can't measure the load on the coal pile."

More recently, the power requirements on passenger cars have increased until 20- and 25-kw. axle generators are common and engineers are saying that 35 kw. is the maximum practical load to take from a single axle. Also the total load has become an appreciable part of the power developed by the locomotive. On a 15-car train having cars equipped with 20-kw. generators, there is a potential load of $20 \times 15 = 300$ kw. $= 400$ hp. Allowing for generator and drive efficiencies, this may be about 500 hp. at the locomotive.

Given these basic factors, the solution of the prob-

lem appears simple, but it is not. The first question is accounting. What is chargeable to the generator? Shall it be fuel alone, a percentage of locomotive operating cost or shall the determining factor be the additional passenger load which might be hauled with extra cars if there were no electrical load. One thing is certain, cost of power will vary with each train and each different road condition.

In the face of all these variables, it is still possible to establish a base figure if two premises are accepted—if it is acceptable to say that electric power should pay its share of locomotive operating cost, and if it may be said that locomotive and generator load factors are about the same.

Then it is only necessary to apply the method to any given case. For example, one road with no heavy grades hauls 15-car trains with a 4,000-hp. Diesel locomotive. It could be 16 cars, but station platforms limit it to 15. Average speed is 57 m.p.h. The total cost of operating the locomotive on this road is $1.11 per mile as measured over a year. One-eighth of this, chargeable to electric power is 13.75 cents. On one car, the figure is one-fifteenth of this amount or 0.923 cents per mile.

If minimum costs per kw.-hr. are wanted, a figure may be taken from the 1946 report of the Committee on Car Electrical Equipment, Electrical Section, Mechanical Division, A.A.R. This report states that an output equivalent to 65 per cent of the continuous rated capacity of an axle generator is about all that can be realized on through passenger runs. Then under best conditions the 20-kw. generator will put out 13 kw. or 13 kw.-hr. in one hour. Since the particular train in question travels 57 miles in one hour and the allocated cost per mile is 0.923 cents, the cost per hour is 52.6 cents. The cost per kw.-hr. then becomes 52.6 divided by 13, or a little over four cents per kw.-hr.

Perhaps to this should be added the cost of carrying weight of electrical equipment and maintenance of generator and battery. That again becomes a matter of accounting. Under less favorable operating conditions or with a locomotive of greater size, the cost indicated in the preceding paragraph would be higher. Under almost no conceivable condition would it be lower, and the figure is offered as a target for anyone else who may wish to offer a better method of procedure.

A Yardstick Of Diesel Wear

The rapidly and continually increasing use of Diesel motive power is gradually shifting the assignment of a growing number of locomotives away from a given run into a general pool much the same as is done with steam power. While this is a trend which is just beginning to manifest itself on a few roads, it is one that will confront additional lines as the Diesel proportion of the motive-power inventory increases. It brings with it several new problems, one of which is to determine just what is the best measure of the rate at which various replacements parts will wear when the locomotive is used on a variety of of trains on different runs and in what manner the interval of replacement of these parts should be measured. Should it be based upon a straight mileage, ton-mile, car-mile basis or the amount of fuel consumed by the engine? To which of these is the wear of such parts as pistons, rings, liners, etc., most closely related?

When Diesel locomotives were first introduced on the railroads they were normally assigned to specific trains. Each locomotive had a particular run with a particular train. As a result mileage was an accurate measure of the wear of the engine parts. With the same schedule, the same train and the same trip every day, the need for parts replacement could be based upon the mileage run. All Diesel road locomotives operated under the same general conditions pulling light high-speed trains. Today the picture is changing. On a growing number of lines the number of Diesel locomotives is, or is becoming, large enough that they are assigned from a pool to a variety of runs. In passenger service the variety may include a range from light fast trains over level territory to heavy slower conventional trains over mountainous districts. Similar variations in an equally proportionate range do or will occur in freight service, and even in switching service. Under such variable conditions might not there exist a better measure than straight mileage for determining the renewing intervals of replacement parts?

One way that suggests itself is to base parts renewal on the amount of work done by the engine. There is a vast amount of difference for example, in the total work output done by a locomotive handling eight or nine light-weight cars in 500 miles of flat country running than a dozen or more conventional cars in an equal-length journey over mountainous terrain. Similarly, the wear of replacement parts would be at a higher rate per mile in the latter case than in the first. Whether the wear would be more directly proportional to the horsepower-hours, or to the total fuel consumed, is a question the answer to which might well prove to be worth the trouble to determine.

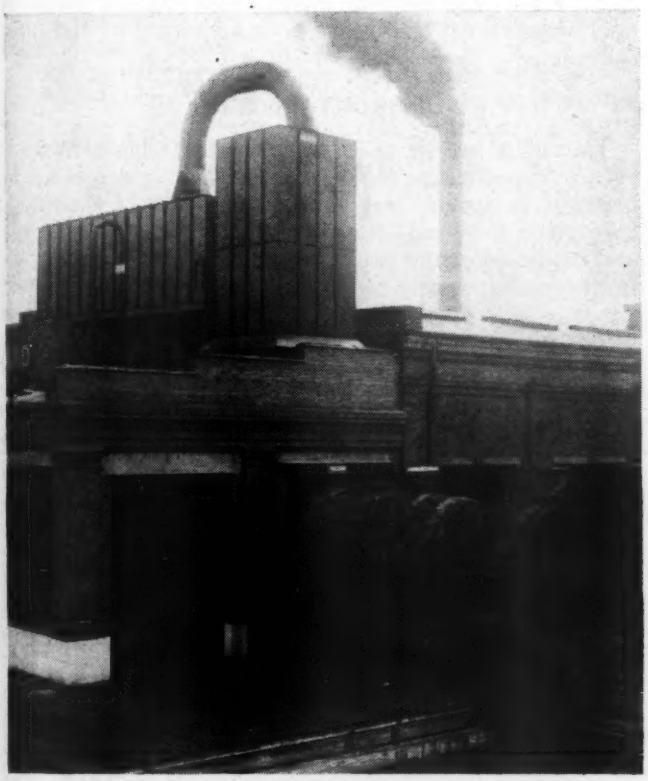
Scheduling parts replacement on the basis of a given total fuel consumption for the engine or the locomotive that is used in a wide variety of service may or may not be worth the added trouble. It will depend on whether the wear of replacement parts, and consequently their need for renewal, is found to follow the total work performed by the engine as measured by the total fuel consumption. If so, a schedule for parts renewal based upon the total number of gallons of fuel used rather than the mileage run could be instituted without great difficulty. The question of its advisability is one that should be studied in view of the changing naure of the assignments given to Diesel locomotives on roads having a substantial amount of this power.

Western Maryland Solves Its

Boiler Cleaning Problems

By Victor F. Stine*

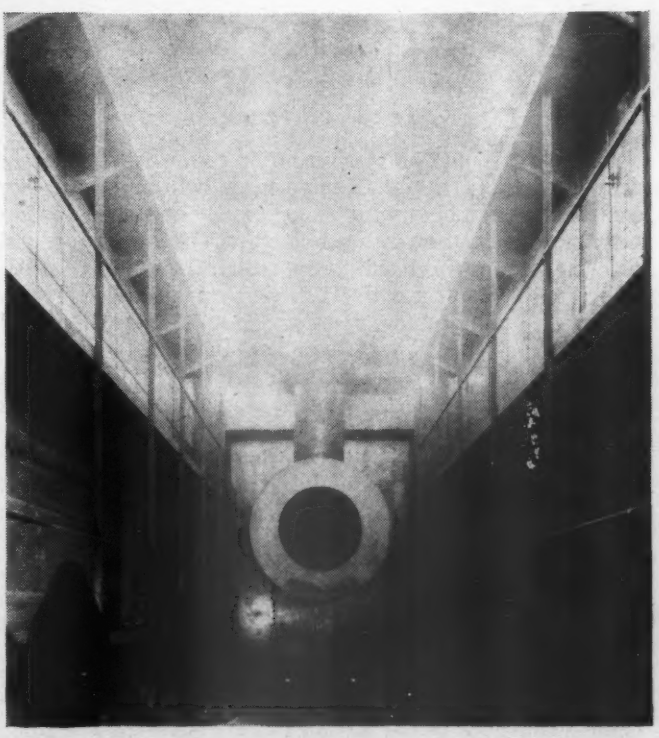
The installation of a shot-blast cleaning room removes hazards of sand blasting and reduces boiler cleaning costs



A stripped locomotive being hauled into the blast room for the boiler-cleaning operation

WHEN the Western Maryland, with its main shops at Hagerstown, Md., decided to change its outdoor sand-blasting method for cleaning locomotive boilers in favor of a completely enclosed Pangborn locomotive and car blasting room, it was done for three chief reasons, namely: to protect the workman from the hazards of open-air sand blasting; to do the job in a more thorough manner in less time; to save money by eliminating a costly and wasteful operating procedure. The outcome of installing the blasting room, capable of handling small castings to a stripped down locomotive weighing approximately 400,000 lb., is the story of how the railroad cut its cleaning costs over 50 per cent. It is also the story of how this shot-abrasive blast-cleaning room now does hundreds of cleaning jobs equally well, including the jobs for which it was designed, and has paid for itself in cleaning time and maintenance hours saved by its cleaning efficiency.

One maintenance problem, which decided the W.M. to change its blasting methods was the cleaning of scale and sludge formed in locomotive boilers by water action, which took too many man hours by sand blasting, in addition to the operation's distinct hazard to workmen. At the blast room's inception, for example, the chief problem was cleaning approximately 80 locomotive boilers each year. The old method of blasting the boilers, removing sludge, flinty scale and corrosion, in order to get the boiler clean enough for inspection of pitting, grooving and excessive wear on boiler and flue sheets, took from 16 to 18 hours of labor. The cutting and cleaning by sand blasting was costly due to the length of time involved, the power used, the two operators' time, the unpleasantness of the job to the workmen, and the continual loss and replace-



Interior of the blast room—Dust-laden air is exhausted through the adjustable hood in the background

*Sales manager, Pangborn Corporation, Hagerstown, Md.

In cleaning the interior of a boiler the vent hood is positioned over the smokebox opening

ment of sand by hand. The blasting room does this same job in eight hours, or less, depending on the condition of the boiler to be cleaned, resulting in a better cleaned surface for inspection, with corresponding labor, time and power costs cut 50 per cent or more. This work is accomplished in an enclosed, dust clear, well-lighted area, complete with every safety and comfort device, and with no additional duties for the workmen except the actual blasting work itself.

The Blast Room

The blast room is a steel enclosed room 84 ft. long, 17 ft. wide and 20 ft. high, located in its own building adjacent to the enginehouse. It is completely equipped for the workmen to do the required cleaning. The operators are protected from the blasting by blast masks and helmets, individually supplied with fresh air from a small separately powered compressor. They are also protected by shotproof aprons, boots, and leggings. Protected extension-cord lights and lampstands are provided with convenient plug-ins enabling them to be used in any part of the boiler, or in any part of the room. The blast room contains two catwalks with railings on each side of the room, assuring accessibility to any part of the equipment to be cleaned. Sixty overhead lights, with sufficient side lights are also provided. A standard gauge track is laid on the floor of the room and heavy equipment may be pulled in the room, either by winch and cable or by a locomotive.

The floor is covered by a steel grating allowing spent shot and small blasting residue to fall through the floor into a V-shaped steel enclosed channel box in a pit, extending the length of the room below the grating. A 14-in. endless conveyor belt at the apex of the inverted V-shaped channel box carries the spent abrasive to a hopper, where it is picked up by an elevator of the belt-and-bucket type enclosed in a dust-tight steel casing. The abrasive is then transferred for processing to the abrasive separator. This equipment is a scientifically correct abrasive reclaimer which removes the contaminated shot, refuse and fines by scaling wheel, air wash, and gravity separation, and returns the good abrasive to the blast-machine hopper for reuse.

Immediately to the rear of the blast room is the control room, containing the elevator, separator, storage tank, and the blast machine, all of which are accessible for servicing. On the wall is the master control panel containing box switches for lights, conveyor, elevator, abrasive, vent hood and vibrator, simplifying control for the operators when both are at work. A manhole and iron ladder to the pit below the blast room makes accessible the lower section of the elevator, the conveyor belt and drive, and the lower hopper. The small compressor supplying air to the workmen's masks and helmets is also in the control room. A door with a small glass port allows viewing of the blast operations.

Operating Procedure

The actual operating procedure of the blast room is simple and efficient. When a locomotive boiler is to be blasted it is run into the room by one of the two methods heretofore described. The vent hood is electrically driven and can be moved vertically from the floor to the aperture in the ceiling where it retracts completely, or to any position between the floor to ceiling. The vent hood is placed into position over the smoke box opening if only the interior of the boiler is to be cleaned. Extension-cord lights are placed in position. Power is turned on at the panel for all blast-room machinery. The operators don their equipment and the work begins, with the dust and residue being blown ahead of the workers. The two hoses used have 7/16-in. nozzles, with the cut-off and adjustment of abrasive flow controlled by the workmen. Eight hours later, or less, the boiler is ready for inspection and repairs, because it is as clean as the day it was installed at the locomotive works. The operators have worked in comfort and safety, and they have done a job that at one time may have taken a crew of men a week.

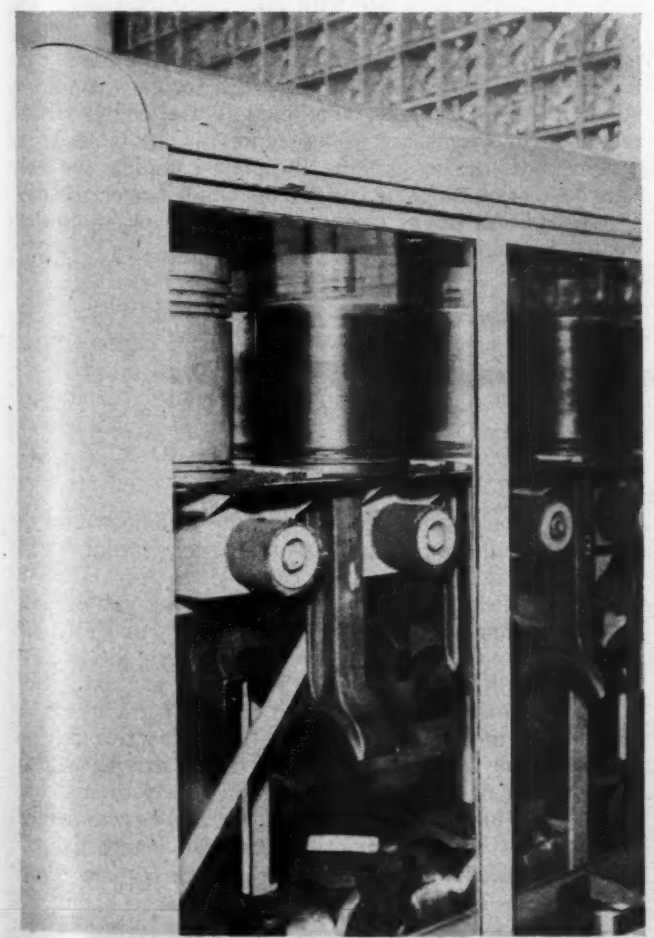
The air used in the actual blasting is the regular shop supply. The air which carries the dust and residue ahead of the workmen during the blasting operations is supplied by an 1,800-r.p.m., 40-hp. motor operating the exhausters mounted on the roof of the building. Simply explained, air is sucked through the intake vents at the rear of the blast room by the exhauster fans moving 27,405 c.f.m. The air flows through the boiler, or past any work in progress, and out through the vent hood, carrying all dust ahead of the workmen who blast with their backs to the air flow. The contaminated air after being picked up by the vent hood is processed through the dust collector.

Excellent maintenance has kept costs to a minimum. Incidentally, the blast operators do their own maintenance, one man having been with the blast room since its installation. Two hoses a year, two nozzles a year, and a few valves renewed have been the extent of maintenance with the exception of careful attention to lubrication. The other item of expenditure is abrasive grit. No. G-16 angular steel grit is used, which is broken down at the rate of 1/10 of 1 per cent per hour, which, plus other abrasive losses, requires a renewal of abrasive of only two 100-lb. sacks daily, or approximately 20 tons each year. The old method of sand blasting and subsequent total loss after passing the nozzles would approximate the 20 tons of shot abrasive used yearly, by the loss of the same amount of sand during the cleaning of one boiler. The sand, of course, is replaced by hand while the abrasive is continually used, cleaned and automatically restored.

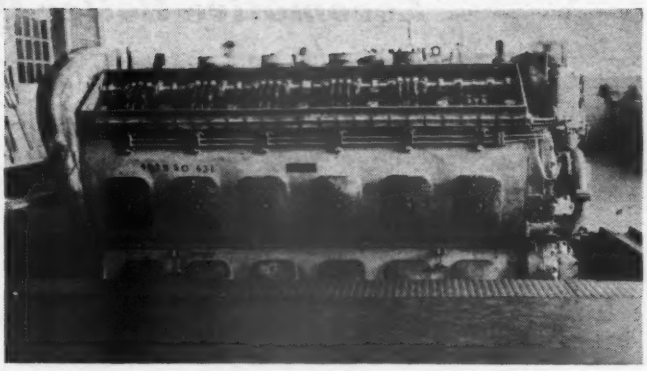
Diesel Engine Assembly Platform

A drop platform has been constructed at the Omaha shops of the Union Pacific which permits the shop forces to work at a level that is both convenient and comfortable while assembling Diesel engines from the bottom up. The Diesel engine frames are mounted on a four-wheel dolly after the engine has been stripped and the engine and parts dipped in a lye vat and blown off with steam. The dolly runs on a standard-gauge track which enters the separate Diesel-engine assembly room from the main part of the back shop. The engine frames are transported on this dolly into the Diesel room and the dolly moved onto the drop platform which is then depressed so that the engine top will be at a convenient height for applying the valves, rockers, etc. At the same time, work can be done at the crankshaft level from plates near the bottom of the floor opening.

The drop platform arrangement has been made flexible to accommodate Diesel engines of various lengths. The opening is large enough to provide sufficient length for raising and lowering the longest Diesel engine. For shorter engines, up to three non-skid plates equal in length to the width of the pit may be laid on supporting members recessed into the floor an amount equal to the thickness of the plate to give a continuous smooth floor surface. The bottom working platform is about 7 ft. below the floor level and is about 1½ ft. wide. This lower working level has two double electrical outlets per side for extension cords or other uses and is illuminated by three lights on each side of the pit. The platform is raised or lowered by a screw jack driven by an electric motor.



One end of the windowed case in which pistons and bearings are kept—The use of glass panes in the sides serves to exclude foreign particles and at the same time admits sufficient light for good visability within the storecase

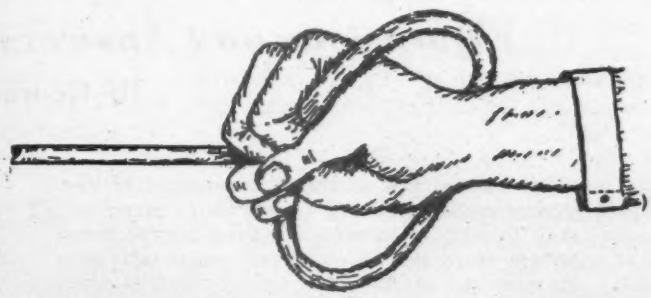


A Diesel engine in place on the drop platform—About 7 ft. below the floor level is another platform of steel plates similar to the ones shown which permit men to work at the crankshaft level without interfering with those assembling the top portion of the engine

Considerable attention is devoted to the exclusion of dirt and dust from the Diesel repair room. The room has a separate heating and ventilating duct. The large access doors which are used for bringing the Diesel engines in on the dollies are kept closed and locked normally. Personnel enter through a small door in the side. As a further precaution against grit and dirt particles entering the Diesel engine, parts such as pistons and bearings are kept in a windowed case. The Diesel repair room is equipped with a 1-ton crane, electrically operated for vertical, transverse and longitudinal movement and with a 1-ton hand hoist.

Safe Handling of Clinker Hooks

The March North Western Newsliner presented an interesting suggestion for safe handling of clinker hooks in cleaning locomotive fires. The first reportable injury to a C. & N. W. employee in 1948 occurred when a fireman broke one of his fingers in pulling back a clinker hook and striking his hand on the coal gate. A great many similar accidents happened in 1947 and,



How a clinker hook should be held to avoid hand injuries

by following instructions with respect to holding clinker hooks, it is said that these injuries can be avoided.

The sketch shows how a clinker hook should be held to avoid injury. This is accomplished simply by placing the hand through the ring and grasping the bar below the ring, thus permitting the ring to act as a guard in the event the clinker hook slips or strikes against objects or a part of the locomotive or tender.

Precautions should also be taken to avoid burns when withdrawing the clinker hook from the firebox. Numerous injuries result from sliding the hand forward along the bar to a point where it is hot.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Butt-Strap Thickness

Q.—What determines the thickness of the butt straps of the longitudinal seam of a locomotive boiler? Is there a formula for computing the thickness of these plates? R.N.T.

A.—The general practice in determining the thickness of the butt straps for the longitudinal seams of locomotive boilers is to follow the table included in the A.S.M.E. Rules for the Construction of Boilers of Locomotives. I do not know of any formula that is used for computing the thickness of the butt straps of a locomotive boiler.

Boiler With Both Solid and Hollow Staybolts

Q.—When applying a new firebox side sheet to one of our 4-6-2 locomotive boilers solid flexible staybolts were used in place of hollow flexible staybolts. The remainder of the staybolts in the boiler are hollow flexible staybolts. Is there any objection to having a boiler equipped with both solid and hollow flexible staybolts? K.R.J.

A.—It is not good practice to renew hollow flexible staybolts with solid staybolts as this defeats the purpose for which the hollow flexible staybolts were originally applied. With the solid flexible staybolts it is necessary to remove the staybolt caps at least once every two years to examine the bolts and sleeves for breakage and the staybolts must be hammer tested at least once each month and also tested immediately after every hydrostatic test. When hollow flexible staybolts are tested each time the hydrostatic test is applied with an electrical or other instrument approved by the Bureau of Locomotive Inspection that will positively indicate when the tell-tale holes are open their entire length, the caps will not be required to be removed. When this test is completed the hydrostatic test must be applied and all staybolts removed which show leakage through the tell-tale hole. There is no objection to having a boiler equipped with both solid and hollow flexible staybolts, except that it complicates the testing procedure in that both methods of testing the staybolts must be used on the same boiler.

Flanging Backheads

Q.—When flanging firebox door sheets and boiler backheads, it is our practice to first flange the outside corners and then with a second heat flang the firedoor holes. Would it not be practical to do this in one heat using one set of dies rather than setting up two separate sets of dies, one set for the outside flange and one set for the firedoor hole?—M.S.T.

A.—The reason for using two sets of dies for flanging the firebox door sheets and backheads is that many classes of locomotives use various types of stokers on the same class of locomotive, requiring different sizes, shapes and locations of the firedoor hole. Thus by flanging the outside flange with one set of dies, the backheads and firebox door sheets can be made with one set of dies each, and later when required, the different firedoor holes can be applied with a small set of dies, thus eliminating the necessity of making a set of large dies for each condition. Also, the firedoor hole, not being in the center of the plate length (rams are in the center of the tables), the bearing pressure in flanging the plate complete with the door hole, would not be equally distributed over the dies. This condition might cause a broken die or an uneven turned flange.

Questions and Answers on Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address o fthe writer, whose identity will not be disclosed without permission to do so.)

Determining Weight Distribution

Q.—I would like to obtain the weight on the driving wheels of one of our Pacific-type locomotives. Our facilities are limited to a track scale, from which I have obtained the actual weight of the engine in working order. Can this weight be distributed to obtain the weight on drivers?—R. V. K.

A.—In order to obtain the weight on the driving wheels of a locomotive from the total weight it is necessary to know the center of gravity of the locomotive. The center of gravity can be obtained by placing the locomotive on a turntable, moving the locomotive on the turntable until the turntable is in balance, i.e., not resting on the rails at either end. The center of the turntable will be at the center of gravity of the locomotive, and measuring the distance from the center of the turntable to any given point on the locomotive will establish the location of the center of gravity with respect to that point. Having both the total weight and center of gravity of the locomotive, the weight can be redistributed through the spring rigging to obtain the weight on the driving wheels. The method of determining locomotive weight distribution is given in the Manual of Standard and Recommended Practice of the Association of American Railroads.

Another method of obtaining the approximate center of gravity using the track scales would be to obtain the weight on the engine truck and the rear spring system independently. This can be done by running the truck on the track scales and taking the weight, then run the engine across the scales so that the engine truck is off

the scales, taking the weight on the driving and trailing truck. From these two weights an approximate center of gravity can be obtained by removing the dead weights and placing the remainder of the weight at the center of gravity of the spring system of the front truck and rear equalizing system respectively. With this center of gravity and using the total scale weight of the locomotive, the weight can be redistributed to obtain the weight on the driving wheels.

Rod Bushing Dimensions

Q.—Our Pacific type locomotives are equipped with main rods having adjustable bearings at the main pin. In converting these rods from adjustable to floating bearings, what determines the thickness of the floating and fixed bushings? F.K.L.

A.—The Association of American Railroads' Manual of Standards and Recommended Practice includes a table for determining the thickness of bushings for main and side rods.

Clearance between Main Rod and Crosshead

Q.—What causes the front end of the main rods of our Pacific type locomotives to cut into the sides of the crosshead? The crossheads are the conventional alligator type. The main rod front-end bearings are brass with an adjustable wedge assembly having 1/16 in. play. B.C.R.

A.—The galling of the inside face of the crosshead by the front edge of the main rod is caused by the lateral movement of the main driving wheels together with the lateral movement of the main rod on the main crank pin. This lateral movement at the back end of the rod causes the front end of the main rod to pinch in against the inside face of the crosshead. Methods used to overcome this trouble include tapering the front end of the main rod 1/16 in. on each side and the use of floating bronze liners between the main rod and the inside face of the crosshead. Some roads use a combination of both methods.

Difference between Seamless Tubing and Pipe

Q.—We have been confused in maintaining various pipes on our locomotives which were originally made of seamless-steel tubing. The difficulty seems to be in ordering seamless-steel pipe as replacement. Is there any appreciable difference between 3½-in. seamless-steel tubing and pipe? F.J.L.

A.—The dimensions of a seamless-steel tube are expressed in terms of the actual outside diameter and the thickness of the wall. Thus a 3½-in. No. 10 B.W. gauge tube has an actual outside diameter of 3½-in., and an actual wall thickness of No. 10 B.W. gauge (0.134 inch), as nearly as the limitations of the manufacturing process will permit. The dimensions of a seamless-steel pipe are expressed in terms of the nominal inside diameter and the weight. Thus a 3½-in. pipe means a pipe which in standard weight has an approximate inside diameter of 3½-in. The outside diameter of this size is 4 in. When the pipe weight is increased to provide greater strength, the additional material is added on the inside because the outside diameter must remain constant so that the same size of threads and fittings may be used. Thus a 3½ in. double extra strong pipe has an outside diameter of 4 in., an inside diameter of 2.728 in. and a wall thickness of 0.636 inch, none of these dimensions corresponding to the size by which the pipe is designated.

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

Safety Control Features

684—*Q.—When does the safety control feature as incorporated with this* 24-RL *brake equipment function?* A.—Only in case the engineman fails to hold down the foot pedal or the automatic brake valve handle, without first making a brake application.

685—*Q.—How much brake application is needed to prevent the safety control feature from functioning?* A.—A brake application of at least 30 lb. brake cylinder pressure.

686—*Q.—What comprises the safety control feature as installed with this brake equipment?* A.—(1)—A diaphragm foot valve, (2)—an *H 24-D* relayair valve unit, (3)—The *DS-24* brake valve safety control details consisting of safety control cock *134,* service application piston *112,* slide valve *114,* dead man check valve *351* and brake valve handle *370,* (4)—a volume reservoir with a check valve located in the pipe to the chamber of service application piston *112.*

687—*Q.—Where is the diaphragm foot valve located and what is its function?* A.—It is located on the safety control pipe and it functions to suppress a brake application when its pedal is depressed and held in the down position.

688—*Q.—How does the* H-24-D *relayair valve unit function?* A.—It operates to prevent a safety control brake application when the brake is applied with a predetermined pressure of 30 lb. or more, permitting release of the foot pedal and brake valve handle.

689—*Q.—What is the function of the volume reservoir and check valve?* A.—To permit the engineman to suppress an inadvertantly initiated safety control brake application by immediately depressing downward either the brake valve handle or the foot pedal of the diaphragm foot valve.

Operation of the Equipment

Safety Control System

690—*Q.—How is the safety control system charged?* A.—By main reservoir air from chamber *A* below service application piston *112* of the *DS-24* brake valve.

691—*Q. How does main reservoir air flow through the service application portion?* A.—From chamber *A* through choke *K* into chamber *B* above service application piston, passage *N,* through safety control cock *134* to passage *10.*

692—*Q.—From passage* 10, *where does the air flow?* A.—From passage *10* to pipe *10.*

693—*Q.—From pipe* 10, *what is the course of air flow?* A.—To passage *10* in the relayair valve to chamber *A.*

694—*Q.—With the brakes released what is the operation in the relayair valve?* A.—With the brakes released and no air pressure in chamber *D* above daiphragm *20,* the diaphragm is in its upward position, valve seat *11* is in its upper position, seating exhaust valve *H.*

With the Car Foremen and Inspectors

Magnaflux

Inspection of Car Parts*

By R. H. Herman†

TESTING passenger-car and freight-car parts is a matter which possibly has not been given the amount of consideration it really deserves on some railroads. When it is decided to purchase Magnaflux testing equipment, usually the first installations are made for axle testing to meet the requirements of the Association of American Railroads, and for steam locomotive parts such as side rods, main rods, piston rods, etc. It is only after sufficient testing outfits are secured to cover these activities that any thought is given to car parts. If we consider the damages, losses and delays which occur when an item such as an equalizer on a passenger car fails in service, then we realize the importance of testing car parts.

Instructions to the various passenger-car shops on the Southern state that equalizers, swing hangers, coupler yokes, and coupler stems must be tested by the Magnaflux method each time they are removed from the truck or car for any reason. On freight-car equipment, however, tests are made only on axles and we do not require regular tests of coupler stems, yokes, truck side frames, or other parts.

Passenger Truck Equalizers

The testing of truck equalizers is extremely important and, in our estimation, is one of the must items in Magnaflux testing. We had a serious derailment shortly before Magnaflux equipment was placed in service, due to failure of an equalizer on an official car, which firmly impressed on us the importance of testing such equalizers.

Magnaflux testing equipment was placed in service in one of our passenger-car repair shops late in 1944. During the first year of operation, 1,185 equalizers were tested and 39 found to be defective. The percentage of cracked equalizers has been less each year and in 1947 only 10 defective units were found out of 1,785 tested. This indicates that old, battered or poorly forged equalizers are gradually being eliminated and we should soon level down to a normal figure.

Most of the cracks were found in the bend adjacent to the journal-box seat, although a few occurred at the spring seat. Normally, the metal section at the spring seat is larger than at bends near the box and not as highly stressed. There is little probability of failure at this point if reasonable care is used in cutting the notches to hold the spring in position. All corners should be rounded with a grinder to avoid any highly stressed or stress-concentration areas where a crack might start.

Only one equalizer was found to have a crack in the web 2½ to 3 in. long, approximately 1 in. deep. This must have been a forging seam which apparently did not progress and might never have failed in service; however, it is our policy to scrap such forgings as a safety measure.

The welding of cracks or fissures in equalizers is generally considered poor practice and we do not attempt to weld or build up worn surfaces. At one time some equalizers were repaired by fire-welding a slab of metal on the top at each end after which the ends wers forged to proper dimensions. This procedure was discontinued some years ago. It is our practice to provide approximately ⅜ in. wear allowance on the bearing surfaces. Such equalizers should last about 15 years and when worn or battered to such an extent that replacement is necessary, we remove and scrap them.

It is my understanding that at least one railroad reclaims worn equalizers by welding or building up the seats whenever necessary. The procedure is to sandblast the equalizers and then Magnaflux test them. If no defects are found, they are built up to original thickness and then annealed. They are then Magnaflux inspected before and after machining. There appears to be quite a difference of opinion as to the desirability of building up worn surfaces on equalizers by welding.

Fissures in Newly Forged Equalizers

When we first started testing equalizers by the Magnaflux method, we were much surprised to find fissures in newly forged bars coming from the blacksmith shop. These fissures were frequently seams or folds resulting from the forging operation, but if allowed to remain at points of high stress, would have eventually resulted in a failure. In an effort to improve the process of manufacturing equalizers for cars as well as locomotives, we have established a new arrangement at one of our large shops.

The process starts with wrought-iron billets in sizes 5 in. by 6 in. to 5 in by 12 in. which are heated in a furnace to a forging heat of approximately 2,400 deg. F. Two heatings are required to block out the bar and four heatings to contour bend the bar to the final shape of the equalizer. Excess material is then trimmed off the billet in an oxyacetylene Travograph machine.

*Paper presented at the second National Conference on Magnaflux Inspection with Magnaflux and Zyglo, held at the Congress Hotel, Chicago, April 12 and 13.

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The bending of the billet to shape is performed in an air press or bulldozer using dies to make the hot bends. Considerable care is taken in this operation in order that the finishing temperature does not fall below 1,700 deg. F. This is essential since wrought iron develops a condition of hot shortness or brittleness in a temperature range of 1,600 to 1,400 deg. F. and the temperature of the piece should not be allowed to drop within this range. A contact pyrometer is used to check temperatures during this operation.

Following the forging operation, the equalizers are again placed in a furnace and heated to approximately 1,000 to 1,200 deg. F., after which they are removed and cut to finish profile on the oxyacetylene Travograph cutting machine using four torches to profile four equalizers simultaneously, guided by a master template. It is important in this profiling operation that every effort be made to keep the position of the grain flow in the bends, as well as in the tentative sections, parallel to the line of the cut. The physical properties of wrought iron parallel to the grain flow show elongation of approximately 30 per cent and reductions in area of approximately 45 per cent, while similar tests perpendicular to the grain flow show elongation of 15 per cent and reduction in area of 15 per cent. In order to obtain the full benefit of the inherent ductility available in wrought iron, it is necessary that the contour profiling parallel the grain line.

In the profiling operation approximately ½ in. to 1 in. of metal is trimmed from the sides of the forging and is completed before the temperature reaches 750 deg. F. The forgings are then returned to the furnace, reheated to 1,700 to 1,750 deg. F., and allowed to cool in shop air. This procedure permits a complete recrystallization of the grain structure in the equalizer with removal of all residual stresses resulting from the forging and profiling operations.

Following the normalizing operation, the equalizers are removed from the oven and the edges left from the flame-cutting operation filletted and buffed with band grinders to remove any irregularities and provide a smooth, rounded surface.

The equalizers are then tested from end to end by the Magnaflux dry powder method and, if satisfactory, are placed in stock. The results from this operation show that to date no fissures or cracks have been found in equalizers.

Tests also show that the grain of the metal runs parallel to the profile of the forging throughout its length, with the exception of approximately ½ in. depth of metal at the bends, which is not considered serious. This method is superior to the previous method of forging the equalizer completely and should eliminate fatigue failures originating at the bends. It is believed that most of these failures were caused by irregular contours produced in the bends by the flatting tool in the forging operation.

The manufacturing procedure outlined above as well as the remarks regarding failures are based primarily on the drop-type equalizer used on four- and six-wheel trucks. However, the same testing procedures will apply on straight equalizers.

Swing Hangers Tested Periodically

The second important item to be considered is the testing of swing hangers. A failure of one of these forgings in service can result in a serious derailment and it is essential that these parts be tested periodically by the Magnaflux method.

Our instructions require that a test be made each time the hanger is removed from the truck. The number of cracked or defective hangers found has been very small. For example, in one year we tested 2,818 with only eight found defective, and the following year 3,856 without any cracked hangers. In spite of this showing we consider the time required in making these tests to be well justified since one failure in service might be much more costly than the money spent for testing over many years.

Coupler yokes and coupler stems on passenger-car equipment are also tested each time the car is in the shop for repairs. The percentage of parts found to be defective is likewise very small and it is possible that the defects might all have been found by a visual examination.

We have given considerable thought to the desirability of Magnaflux testing freight-car couplers and yokes. The couplers, when removed from a car, are carefully checked to determine whether they are within the gauge limits of the A.A.R. interchange rules and examined for cracks at any point. Second-hand or reconditioned couplers may be reapplied provided the distance from striking horn to butt and from pulling surface of key slot to butt are within prescribed dimensions and all cracks welded.

Reclamation plants have been set up for couplers where the stem is heated in a furnace and upset in a press to restore the key slot to proper size and square the worn surface of the butt. A steel plate of correct thickness is then welded to the butt to maintain desired length.

The Code of Rules does not require Magnaflux test of couplers at any time during the reclamation process. However, it appears that there is a definite need for such test of these parts before they are reworked, and it might be equally desirable after welding. There is some opinion that any fissures or cracks will show up and can be easily detected when the coupler is heated in a furnace for reclamation. I am sure that some discussion on this question of Magnaflux testing freight-car couplers and also yokes will be of value, and I would like to know if any railroads are making a standard practice of testing these parts.

Freight-Car-Truck Side Frames

The testing of freight-car-truck side frames was discussed at the last Magnaflux Conference and at that time there did not seem to be any decided opinion in favor of such tests. As most of you know, the interchange rules have been revised this year with respect to truck side frames. Second-hand side frames must not be applied unless entirely free from cracks, fractures, excessive wear, excessive corrosion and, if cracked, must be properly welded and normalized. The application of welded truck side frames having T- or L-section compression or tension members is prohibited.

The method prescribed for testing second-hand side frames of the T- or L-section design, if not welded, or any other section cast in 1926 or prior years, calls for heating in a furnace to a temperature of approximately 750 deg. F., after which careful inspection is made. The rules prohibit painting new or second-hand truck sides or other truck parts to insure detection of flaws by ordinary inspection.

After studying these rules, the thought immediately comes to mind that truck side frames could be tested much more satisfactorily by the Magnaflux test method and with more assurance that any existing cracks or fissures would be detected. The purpose of heating in a furnace is no doubt to burn off all coats of paint and improve visibility on inspection. However, if all loose paint, etc., is removed with a wire brush, Magnaflux

tests should be much more sensitive in locating cracks or fissures in the side frame than by visual inspection.

All of the above items can be most satisfactorily tested by the dry powder method using alternating current. We are primarily interested in surface fissures or cracks. The a.c. method with a gray powder provides a very satisfactory and sensitive test.

The volume of such parts, even in a large car repair shop, is not sufficient to justify a production setup. We use a portable testing machine which provides three steps of current to a maximum of 2,500 amp., and we place equalizers, couplers, yokes and other heavy forgings on blocks or other supports. The actual tests are made by wrapping three turns of cable around the part with a current of approximately 500 amp. and applying the powder with a motor-driven powder blower. Most of these parts are tested in the truck shop where they are handled and moved by jib or overhead traveling cranes.

Each individual shop maintains a record of all items tested on a particular car, together with the date such test was made. If a part is found to be cracked, a separate report is made immediately to the mechanical engineer, listing all identifications, the size and location of the crack by marking up a sketch, and the disposition, i.e. whether reclaimed or scrapped.

Summary Test Record Proves Valuable

Each month, a summary sheet is sent in listing the total number of parts tested of each type, the number found cracked and the number reclaimed. This procedure has been in operation for several years and has been found to be very satisfactory. A close check can be kept of Magnaflux testing operations without imposing an excessive burden of paper work on shop officials.

There are numerous other truck parts which may or may not justify Magnaflux test, some of which can be mentioned briefly.

We have a center brake-lever connection on most of our six-wheel trucks which is subject to high stresses. Furthermore, it is so located that a failure would undoubtedly result in a derailment of the truck. Parts such as this should no doubt be tested at regular intervals.

Several breaks in passenger-car truck frames have been found at various times by visual inspection, but to date we have not Magnaflux tested any frames. In several cases the break was not detected until the car arrived in the shop for general repairs. It is questionable whether testing of these truck frames is justified.

A test might be made of brake rods, particularly the threaded portion. However, in our experience, little trouble has been encountered with failures of such rods.

We have, likewise, never considered testing of journal-box castings on passenger cars. Some trouble has been experienced with sections breaking out of the top of the box where the equalizer rests but this trouble has not been serious and usually is due to excessive wear.

Swing-hanger pins, knuckle pins, springs, air-brake gear, and highly stressed parts on specially designed trucks are items which might be tested to advantage.

It must be emphasized that the question of what to test and what not to test is one that each railroad must decide after thorough consideration. The proper testing of parts involves considerable handling expense in addition to actual labor required in making the tests. On the other hand, if such tests eliminate only one serious wreck or derailment, they may be considered well worth while.

Brake-Cylinder-Release Valve Speeds

Freight-Car Handling in Yards

Application of 5,000 new valves authorized—Promise to save 70 per cent in release and 50 per cent in recharging time—Average combined saving of $.038 to $.065 per car switched in wages alone

THE brake-cylinder-release valve, described briefly in the February, 1948, *Railway Mechanical Engineer*, has been refined in some details and is now authorized for application to 5,000 cars in interchange service for practical railroad experience, according to a circular letter recently issued by the A.A.R. Mechanical Division. The letter summarized results of a preliminary survey in yards on several railroads which indicated savings of 70 per cent in time required for releasing or bleeding present standard AB brake equipment; 50 per cent in recharging time regardless of train length, and $.038 to $.065 per car per switching operation in wages of train crew and car inspectors.

Bleeding

In connection with bleeding cars, the letter states that, in the present AB brake equipment this is done by pulling the release rod and holding the release valve open until all the air is drained from the brake cylinder and from both the auxiliary and emergency reservoirs. With the brake-cylinder-release valve, the cylinder alone is drained, the valve being set to complete the draining with a manual operation that is only momentary. In a recent test conducted under A.A.R. supervision on 24-ft. hopper cars, approximately 22 sec. per car was required for bleeding the present standard equipment and an 80 per cent time saving resulted from the use of the brake-cylinder-release valve. From the survey, however, it appears that in ordinary practice the average time required per freight car is 30 to 35 sec. It is not unreasonable to expect a time saving of at least 70 per cent in ordinary practice with the brake-cylinder-release valve, which will then require on the average only 9 or 10 sec. to bleed each car.

A prevalent practice is the blocking open of the release-valve-rod handle to avoid waiting for complete release of the air in the system. This is undesirable since often blocks are not removed, causing trouble and delays in recharging and making brake tests on departing trains. Since there is no waiting required and no need for holding the release rod with the brake-cylinder-release valve, this practice would disappear. Even where blocking is admitted, the best bleeding time shown on the survey reports is approximately 24 sec. per car. In many yards bleeding is done during the inbound inspection, sometimes by the inspectors and sometimes by additional personnel. In the latter case the services of special personnel could be dispensed with, since it would require only a momentary pull of the release rod and it is customary to require car inspectors to carry this out as a part of their regular duties. In such cases where the inspectors now do the bleeding there is a possible time saving of about 22 sec. per car, or about 6 hr. per 1,000 cars handled. This can be converted either to a saving in personnel or to a speeding up of yard operation.

In cases where bleeding is not combined with an inbound inspection, the time required is often critical since switching or humping must wait until the process is completed. Generally, special personnel is assigned to this job. The saving possible with the brake-cylinder-release valve is quite pronounced, whether it is taken in personnel or operating time, or both. A given number of cars can be bled either in one-fourth of the time now required or in the same time with one-fourth the personnel. In a yard handling 1,000 cars per day, approximately six to seven man hours can be saved. If bleeding is done by a single man for each train in the same yard, there is available an operating time saving of six to seven hours per day, which should increase operating speed and efficiency considerably. Based on current straight-time wage scales for car inspectors, there would result a saving of approximately $.008 per car per operation.

In some yards, the bleeding is done by the switching crew. This means that for much of the time not only are the conductor and his men tied up but the switch engine and its crew as well. In one yard where some 2,200 cars are classified daily, a time saving of about 11½ hrs. is indicated, and this reflects both toward a saving in personnel and a speeding up of operations. The economic saving could amount, under such circumstances, to as much as $.035 per car per operation.

In yards handling fewer cars and in local freight service where switching is done along the line, the personnel and operating time saving, of course, depends on the circumstances, but in most cases movements could be expedited to a considerable degree. For example, in bleeding ten cars to cut out of a local freight, about 5 min. are generally required. This could be reduced to less than 1½ min., with a saving of 3½ min. on the operation. Multiplied by the number of times this might occur on a run, the saving becomes quite appreciable.

Charging

It is recharging cars after classification that the major advantage of the brake-cylinder-release valve shows up. Since this valve releases the air in the brake cylinder alone, the reservoirs are left charged to about 60 lb. per sq. in. Even when the time between bleeding and recharging covers a period of several hours, under normal leakage conditions enough air will remain in the reservoirs to reduce the recharging time by at least 50 per cent on any length train.

Generally speaking, it requires 12, 18, 30, 40 and 60 min. to charge trains of 25, 50, 75, 100 and 125 car lengths, respectively, to the point where a brake test can be made. A saving of 50 per cent of this time in delay to departing trains in many yards is an almost priceless feature.

In a classification yard now adequate for maximum traffic conditions and despatching ten trains of 75-car lengths, the saving would be 15 min. per train, or 2½ hrs. a day. Considering the crews, motive power and yard facilities tied up as well as the delay in train time, this is an important saving. In fact, on a straight-time basis at current wage scales, the expenses of crew and car inspectors alone would amount to $22 to $24 per day, or about $.03 per car despatched.

Many large yards use yard-charging plants connected to their outbound tracks. These installations are expensive to install, maintain and operate, and in many cases they are so unreliable in the winter months that they are seldom used. It is conceivable that the faster recharging time available with the brake-cylinder-release valve would make many yard-charging plants unnecessary.

In some yards covered in the survey, the outbound assembly tracks are of insufficient length to accommodate the average departing trains. In such yards trains are doubled over on the lead track where they are charged. Since this operation blocks a portion of the yard, the time required for recharging is extremely critical.

On expedited movement through classification yards, or in other cases where the time between bleeding and recharging is relatively short, the possible saving in charging time is even greater than 50 per cent. Where the time is cut to one or two hours, this saving increases to about 75 per cent. Many of such expedited operations deal with high-class freight where time saving is extremely important.

Where a terminal yard is now found to be so badly congested on account of delays to departing trains as to be judged inadequate for the traffic handled, the obvious correction is an expansion of the size and facilities of the yard by a major capital expenditure which thereafter must be maintained in good times or bad. How, then, can an estimate be made of the value of a simple device on each car, if such a device would more than restore the adequacy of the present yard for maximum traffic and at the same time expedite the movement of cars over the railroad as a whole and increase the availability of equipment?

The charging-time saving in local freight operation is difficult to evaluate since cars picked up have often been set out for comparatively long periods during which leakage has had time to reduce or deplete the air pressure left in the reservoirs. Most AB equipments are capable of retaining air over a period of days when brake-cylinder leakage is not a factor. It is safe to conclude, however, that on the average, there would be a substantial reduction of the delays to train movement because of "waiting for the added cars to charge" at local points between terminals.

Reduced Air Consumption

When the present AB brake equipment is bled, all the air in some 6,000 cu. in. of reservoir volume is exhausted. Assuming that, on the average, 45 lb. per sq. in. or three atmospheres pressure can be retained in the reservoirs to the time of recharging, there is another economic advantage to the use of the brake-cylinder-release valve. In a yard classifying 1,000 cars daily, this amounts to 10,000 cu. ft. of free air per day. The cost of this air, of course, depends on whether it comes from a locomotive or a stationary compressor, and also on what main reservoir or storage reservoir pressure is used, but as a comparison it would require the work of an 8½-in. 150-cu. ft. per min. cross-compound compressor working at its rated capacity for about 1 hr. and 10 min., and this does not take into account any line leakage during the time for charging.

Summary

From the above analysis it appears that there would be an average combined saving of at least $.038 per car per switching operation in straight-time wages of train crew and inspector personnel, and that this figure might be as high as $.065 in some yards. This does not at all take into account the indefinite but highly important saving resulting from the increase in yard capacity, speeding up of the overall movement of trains, and reduction in the economic hazard of trying to regain lost time. Assuming that the average freight train is involved in 200 switching movements per year in which the air is now bled from the brake system, a tangible saving of at least $7.60 per car per year is indicated. The current price of the brake-cylinder-release valve is $24.75 and it has been estimated that the total cost to the railroads, when installed on a car, will average $31.00.

Hold-Down Clips For Hopper Cars

Far too many holes are being burned in car bodies to accommodate tie-down bands, etc., used to secure lading, according to an A.A.R. Mechanical Division circular letter dated April 22. The letter mentions hold-down clips for gondola cars (See A.A.R. Supplement to Manual Plate 803) which eliminate the necessity for burning or drilling holes and slots in car bodies to accommodate tie-down bands, rods, wires, etc., on *new* cars equipped with these details, but states that this will not have the effect of eliminating difficulty in so far as existing equipment is concerned.

According to the letter, complaints are continually being received from member roads regarding mutilation of gondola cars, many having a considerable number of holes and slots burned out, etc., causing a great deal of damage and weakening the car structure, particularly when an excessive number of large holes or slots are burned in top-chord angles. Where such holes are burned in the bodies below the top portion, the cars must be shopped to patch the holes before they can be loaded with sand, gravel, ore, slack coal and similar bulk commodities.

This matter has been before the Committee on Car Construction, and Plate 803, referred to above, has been modified as illustrated on attached Plate 803-A which will be recommended in the committee's 1948 report for adoption as standard practice.

The Committee on Car Construction recommends, as explained in the letter, that all railroads now building new gondola car equipment apply hold-down clips as per Plate 803-A. The committee also urges that when gondola cars are rebuilt or receive general repairs, these hold-down clips be applied. A large portion of steel gondola car equipment now in service has no means for ready attachment of bands, wires, cables, rods, etc., for securing many types of lading, and it is an inconvenience and expense to the shippers to have to burn out holes or slots for this purpose every time lading of such character is loaded. Furthermore, the absence of hold-down details leaves the shipper with no alternative but to cut mutilating holes in the car body.

Drying Room At St. Cloud Shops

Sixteen new steel box cars were built daily at the Great Northern car shops, St. Cloud, Minn., in completing a program of 500 cars during February and March, and the construction of 500 more cars was scheduled to start with the arrival of additional material which was expected in May.

In use for the first time at the St. Cloud shops is a new drying room, in which the exterior side paint on each car is hardened in 20 min. by banks of infra-red electric lamps which extend the full length of the 40-ft. car.

The 1,000 cars weigh 40,800 lb. each and have a rated load capacity of 50 tons. The underframes are of welded steel, and the steel sheathing is riveted. Wheels are

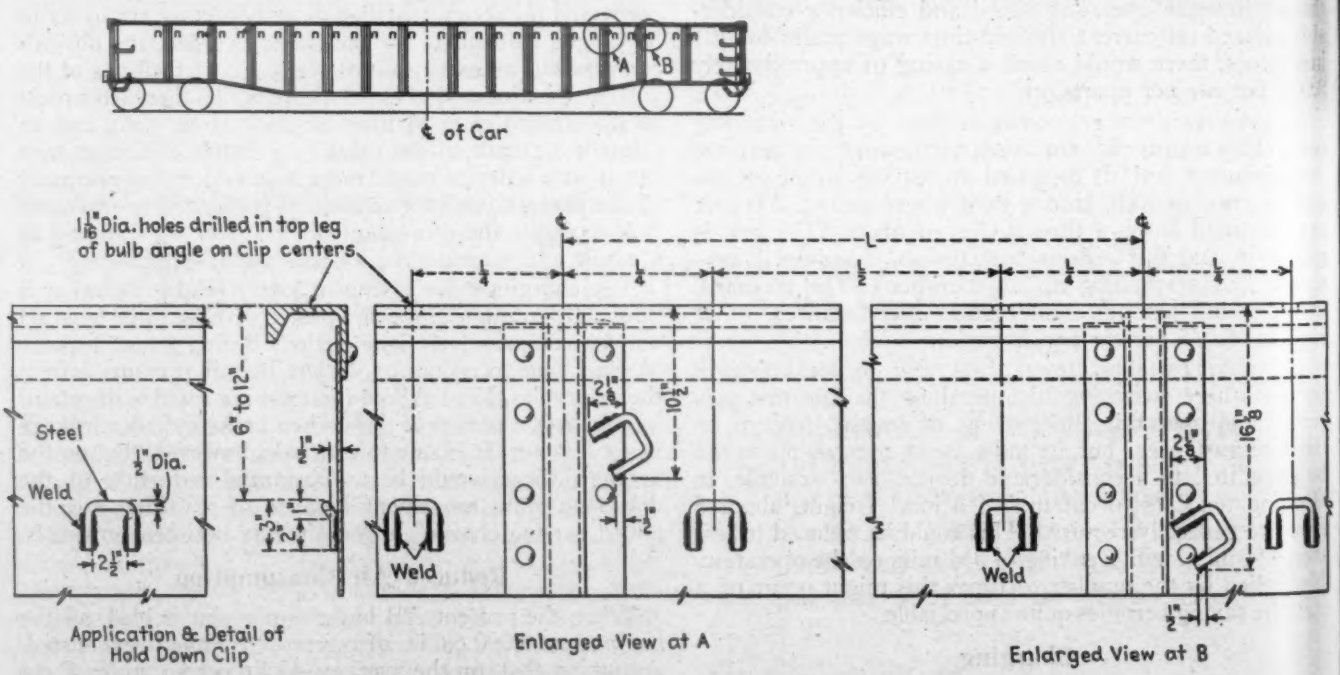
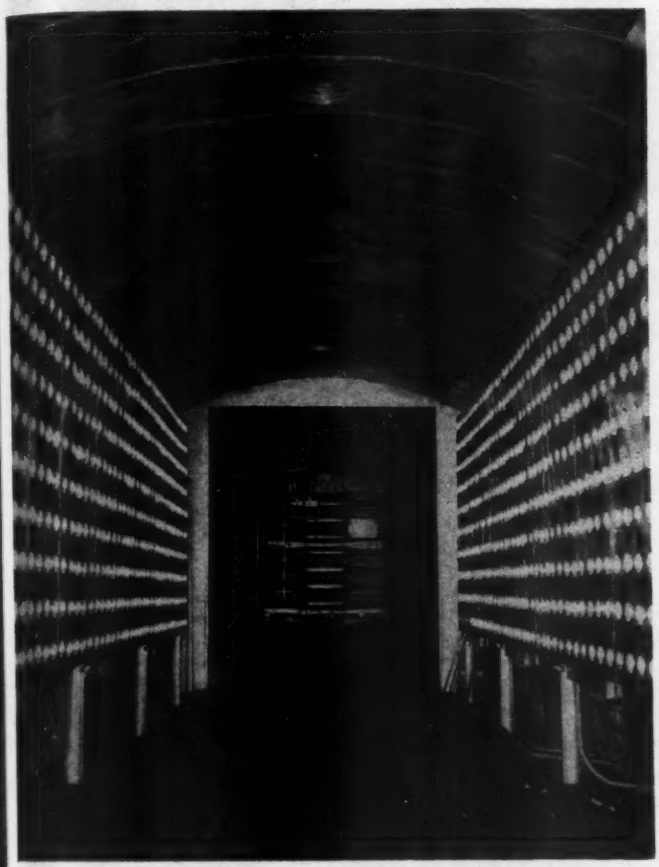


Plate 803-A—Proposed arrangement and detail of hold-down clips for use on gondola cars

of steel. The total cost of the 1,000 cars will be $4,500,000. The underframes are assembled at the railway's Superior, Wis., shops and the balance of the work is done at St. Cloud.

To promote safety and for ease of reading car numbers and other designations, Scotchlite reflective material is used for the railway's monogram, large lettering and numbering, and a row of small circles along the bottom of the car sides. At night these reflective areas become vivid when automobile or other lights shine on them.



Paint drying room at St. Cloud shops—The lamps are infra-red

When the Great Northern began turning out box cars rapidly it became evident that some way of drying the side paint was needed to keep the line moving. This was essential because the Scotchlite is applied after the paint hardens and is left to natural drying. The paint wasn't hardening quickly enough to permit efficient operation or getting the cars finished on time. So the drying room was devised. All the designing and installation was done by Great Northern forces.

The drying room was built inside a shop building. It is 50 ft. long, 17 ft. wide, and 17¼ ft. high. An automatic door at one end of the room gives entrance to, and exit from, the shop building. Fireproof pull-curtains are installed at both ends of the room, and these are in place when the room is used. The total electric lighting load is 175 kw. Spray painting of the cars is done inside the shop building, quite close to the dryer.

Each side of the dryer has 40 ft. of lamps. Cars longer than 40 ft. can be handled if need be. Each side has three panels of 390 infra-red lamps, or a total of 780. The lamps, ten rows high and 13 rows wide, are lined up on one-foot centers in square pattern, so there is a foot between the center of each lamp horizontally and vertically in the rows. The sockets are mounted on channels carrying the wires. Westinghouse R-40 250-watt lamps are used throughout with built-in reflectors. Flat polished aluminum sheeting is attached to the panels to set almost flush with the front of the lamps. The panels and reflectors were built by the Great Northern.

The lamp banks are located 15 in. from the car sides, and 18 in. is allowed between the panels and the room walls to permit work on the panel backs.

Transformers are 2,400/4,160 primary and 120/240 secondary, 50-kv.a. 60-cycle and oil-cooled. Explosion-proof circuit breakers are used.

The ceiling of steel plates with aluminum paint finish helps confine the heat. There are three ceiling outlets for ventilation. No lamps are in the ceiling.

Car ends are not baked and neither is the roof. The lamps are used on the car sides only where the Scotchlite is applied. Each car is in the room 20 min., with a temperature at 180 deg. Two coats of paint are sprayed on before a car is brought in. The first is allowed to stand 15 or 20 min. to harden beyond the running stage before the second goes on. This means that the room actually hardens two coats of paint during one 20-min. stay therein.

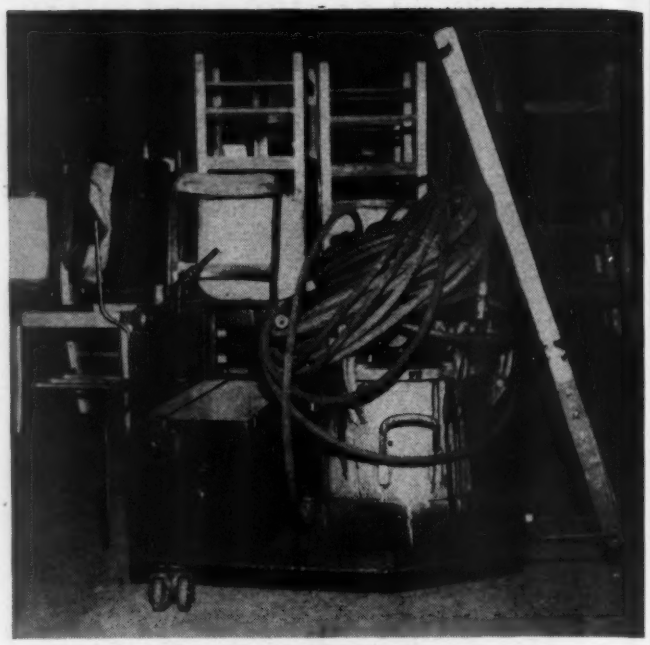
Some of the new steel box cars built early this year at St. Cloud shops

Cart for Painting Apparatus

SHOP forces at the Chicago, Rock Island & Pacific's Forty-ninth street passenger-car shops, Chicago, have designed and constructed a three-wheel paint cart that is large enough to carry those parts of spraying equipment which it is more economical to transport than to locate at the job. At the same time the cart is small enough to be easily maneuverable; its lack of space to accommodate heavy or bulky equipment which is more economically located at or near the job being performed serves also to contribute to the overall efficiency of the spray painting system.

The cart carries a five-gallon paint container, complete with the air hose that runs from the tank to the spray gun and an agitator to keep the paint continuously mixed. There is a filter for removing the water from the air and two pressure gauges, one measuring the air-line pressure and the other the spray-line pressure. Behind the spray tank is a tool box which contains the necessary wrenches, pliers, screw drivers, etc., for making adjustments to the spraying apparatus. This is fitted with a locking arrangement so that the individual workman can be issued his own tools for which he is held responsible. Auxiliary apparatus, such as extension cords and the main air hose from the air connection to the spray tank, are stored convenient to each group of the type of outlet they fit to save both unnecessary transportation and unnecessary wear from bending and kinking.

The cart is made mainly from 20-gauge plate, and the base is 20 in. wide and a little over 3 ft. long. It is essentially rectangular except that near the front the sides taper inward to a width of 8 in.; it is in this part that the spray tank rests. The tank, and whatever else the cart may be transporting at the time, is restrained from sliding off the base by 1¼-in. angle iron welded around the base. The



Paint cart made by the Rock Island shop forces

tool box is also made of 20-gauge iron and is 20 in. long, 11 in. high and 9 in. wide. A hinged 1-in. strap fits across the tool box. Into an opening in the end of this strap fits a lock which locks the tool box. On the back of the cart is welded a ⅜-in. rod shaped for winding a hose on it. The wooden handle is made from a two-by-four. Two lengths of strap iron are bolted to the wood on each side and join the handle to the cart body through a length of ⅜-in. rod bent to a U-shape.

* * *

This Shell Oil Company picture shows a tank-car truck undergoing repairs at the company's car shop at the Houston, Tex., refinery—Before a car leaves the shop, any defective parts will have been replaced; the journal boxes repacked; the tank sanded, chipped, examined for leaks and repainted to protect it from corrosion

Basic Requirements of Car Heating and Cooling

By Maurice R. Eastin*

An outline of how air-conditioning controls should be coordinated to produce most satisfactory winter heating and summer cooling

SINCE a temperature control system for railway passenger cars can be applied to control heating and cooling systems in many different manners, it is important that very careful consideration be given to the functions of the various parts of the heating and cooling system so that they can be controlled in a manner consistent with their basic functions in the system. There are some fundamental differences between the problems encountered during heating and cooling, and it is therefore convenient to examine these separately.

Heating

In general, two sources of heat are available in the car,—the side-wall heating surfaces and the overhead system. It is possible to heat the railroad car using the side-wall surfaces only. In fact, this manner of heating is normally used for standby heating when the overhead system is not operating. Also, before air conditioning systems were installed on railroad cars, they were heated by means of side-wall heating systems only.

There are some basic disadvantages, however, to heating the car by means of the side-wall surfaces. In the first place, there is no ventilation, since the overhead system would not be operating. This would result in stale air and a close condition in the car. Also, there would be undesirable stratification of air because there would be no forced air circulation in the car. This would mean that temperatures would be much higher near the ceiling than they would be at floor level.

Another very serious disadvantage of this means of heating the car is the discomfort which would be experienced by the passengers sitting in the window seats because of the large amount of heat being given out by the side-wall surfaces. In order to supply all the heat required by the car, the output of these side-wall surfaces would have to be very large and this large source of heat adjacent to the passengers in the window seats would make them uncomfortable. The situation would be somewhat similar to heating a room with an old-fashioned stove. Then, faces of people turned toward the stove are usually too warm while there is a definite feeling of chill on their backs which are turned away from the stove.

It would also be possible to heat the car using only the overhead system. The overhead system has sufficient capacity, because less air is normally required for forced air heating than is required for cooling. A serious disadvantage of this method of heating, however, is the discomfort that would be experienced by the passengers in the window seats due to cold window and wall surfaces near them. Being next to a very cold surface can cause considerable discomfort, even when air temperature conditions are satisfactory. This is a frequent experience when sitting next to any cold window in the wintertime.

Since neither the side-wall heating surfaces nor the overhead system can satisfactorily heat the car alone, for comfort it is logical to use both of them. Then, since the overhead heating system gives good performance except for the chilling due to the cold windows, it can handle the basic job of heating the air in the car provided that heat is supplied from the side-wall surfaces in such a manner as to counteract the cold windows and walls. This is very easily done since the location of the side-wall surfaces is directly under the windows and the heat from the side-wall surfaces naturally rises over the car windows. Also, supplying some of the heat for the car near the floor helps reduce the stratification.

Since a logical consideration of the problem of heating a railroad car indicates that the main purpose of the overhead system should be to maintain car air temperatures and the main purpose of the side-wall system should be to prevent the chilling of passengers by the cold windows, we should control the heat output of the sidewall surfaces and the overhead system on this basis. If we do this, the two systems will work as a team to give us the comfort conditions in the railroad car that we are trying to obtain.

Overhead Heating Controls

First consider the applications of controls to the overhead system so as to maintain car temperature. The basic control would naturally come from a car thermostat located in the car space itself and responsive to air temperature in the car. This car thermostat should control a heating valve on the overhead coil so as to supply sufficient heat to maintain car temperature.

This type of simple control system has two serious disadvantages. The first is that when outdoor temperatures drop, there is no correction in the control system until the temperature in the car drops enough to actuate the thermostat and increased heat has begun to flow to the space. Therefore, there is at least a momentary

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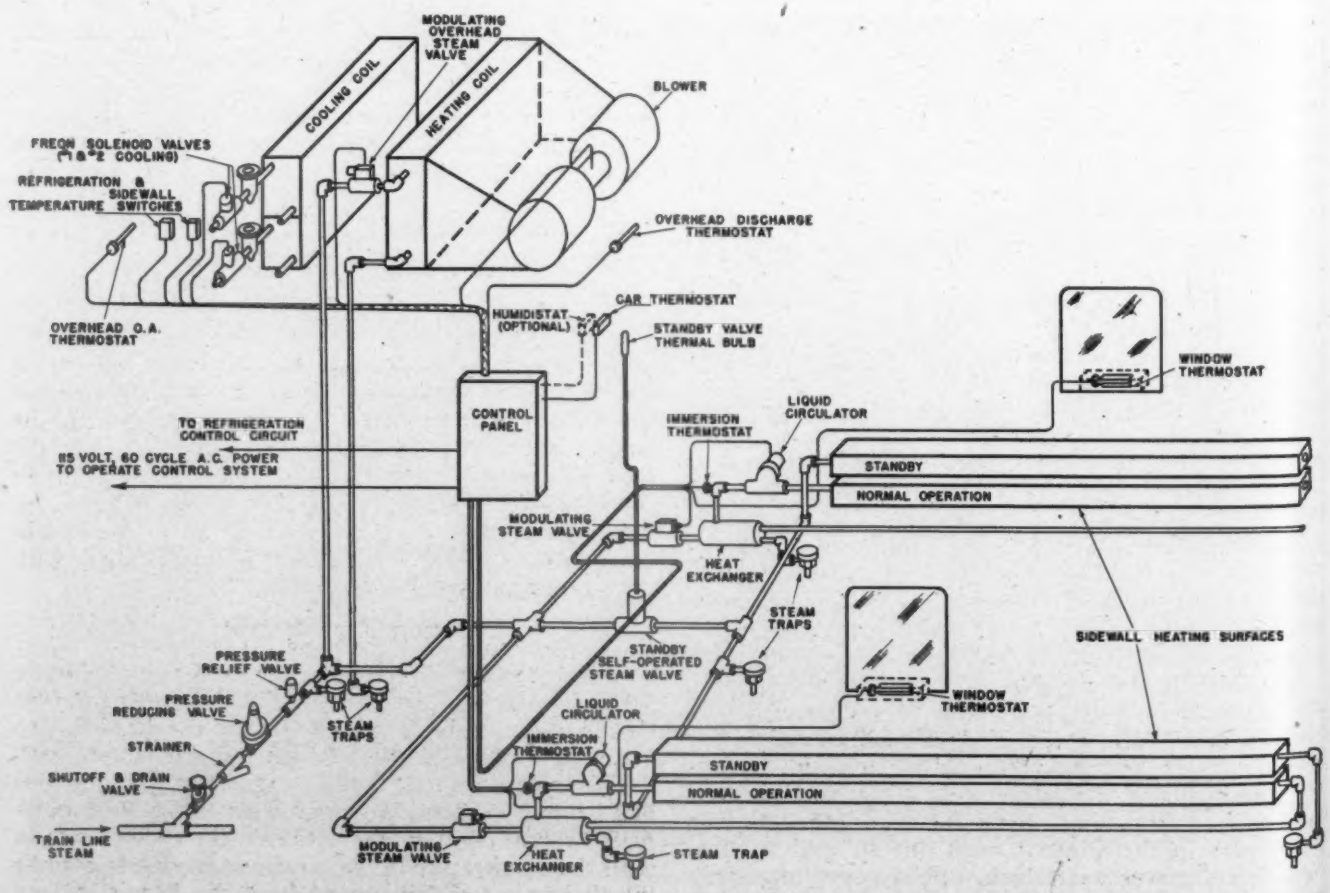
drop in car temperature. This can be prevented by locating another thermostat in the outdoor air to detect changes in outdoor conditions and to make advance corrections before conditions in the car change. If this thermostat would operate perfectly, and there was no change in occupancy, the car thermostat would actually have no job to do since the requirements for a varying amount of heat would be anticipated by the outdoor thermostat and the necessary correction made. The car thermostat still performs the function of correcting the heat input for changes in occupancy.

The other problem which is still left is the tendency of the control system to overshoot. When additional heat is required because of a reduction in the outdoor temperature, it is necessary to first apply enough heat to bring the car temperature back to normal conditions, and then only sufficient heat to maintain these conditions. When the heat output is reduced, the extra heat stored in the system is still supplied to the space and causes the temperature to overshoot. This overshooting can be prevented by locating another thermostat in the discharge air which reduces discharge air temperatures gradually and thereby reduces overshooting. These three controls working as a team can maintain accurate car temperatures with wide variations of outdoor temperatures and conditions.

There is another way to look at this control problem which may make the functions of the outdoor air and discharge air thermostats clearer. The car thermostat can do a better job if it is required to make minor corrections only. To satisfy this requirement, the outdoor air thermostat may be used to determine the discharge air temperature which is approximately correct and position the steam valve so as to obtain this temperature at the discharge air thermostat. With no occupancy, this will maintain accurate car temperature. However, changes in occupancy, door openings and other imposed conditions require some minor corrections and the car thermostat acts as a vernier control which makes the final necessary adjustments to maintain the car temperature exactly at its control point.

Side-wall Heating Controls

The load on the side-wall heating surfaces is somewhat more complicated. Side-wall heating surfaces should be controlled so as to eliminate the chilling effect of the cold windows and walls. This chilling effect depends on the actual temperature of these windows and walls which in turn depends on the outdoor temperature, the wind velocity, the amount of sunshine on the car, and the inside car temperature. This may look like a complicated number of effects which would be very difficult to measure. Actually, the problem is considerably simplified by the fact that the temperature of the inside window glass can be measured directly and to determine the amount of heat required. Therefore, if a thermostat is placed on this inside glass surface, this thermostat will indicate the amount of heat required from the side-wall surfaces. This thermostat in turn can either position a steam valve which supplies steam directly to the side-wall surfaces or, to obtain more accurate control, it can position a steam valve which supplies steam to a heat exchanger heating a liquid which is circulated through the side-wall surfaces. In this case, the discharge liquid thermostat is used to make sure that the correct amount of heating output as called for by the window thermostat is obtained. Use of a circulating liquid makes it possible to obtain very little output from the side-wall surfaces when it is necessary to prevent overheating during mild weather, since liquid temperatures can be reduced to any desired level.



Typical application of an electronic air-conditioning control system to a railroad passenger coach

When the sun is shining on one side of the car, considerably less heat is required on that side of the car to offset the cold walls and windows. This correction is secured automatically by the sun shining on the window thermostat, with the result that the side-wall output is reduced on the sunny side, so that the passengers on this side of the car are just as comfortable as those on the shady side.

This combination of controls produces accurate car temperature at all times with comfort assured by the elimination of the effects of cold walls and windows.

Cooling

The problem of cooling a railroad car is very similar to the problem of heating. The function of the side-wall heating surfaces, however, is not so critical in the summer time because of the smaller difference between car temperatures and outdoor temperatures. For instance, if car temperatures are maintained at 73 deg., the maximum temperature outdoors would probably be 100 deg., while the lowest temperature that we might have outdoors would be minus 40 deg. Therefore, during the summer the difference between indoor and outdoor temperature would not exceed 27 deg., while in the winter the difference would run as high as 113 deg. This means that the car walls and windows will not cause as much discomfort when they are warm in the summer as they would cause when cold in the winter, since their temperature would vary only slightly from indoor temperature. Therefore, the local tempering action of the side-wall surfaces is not as important during the cooling cycle as during the heating cycle.

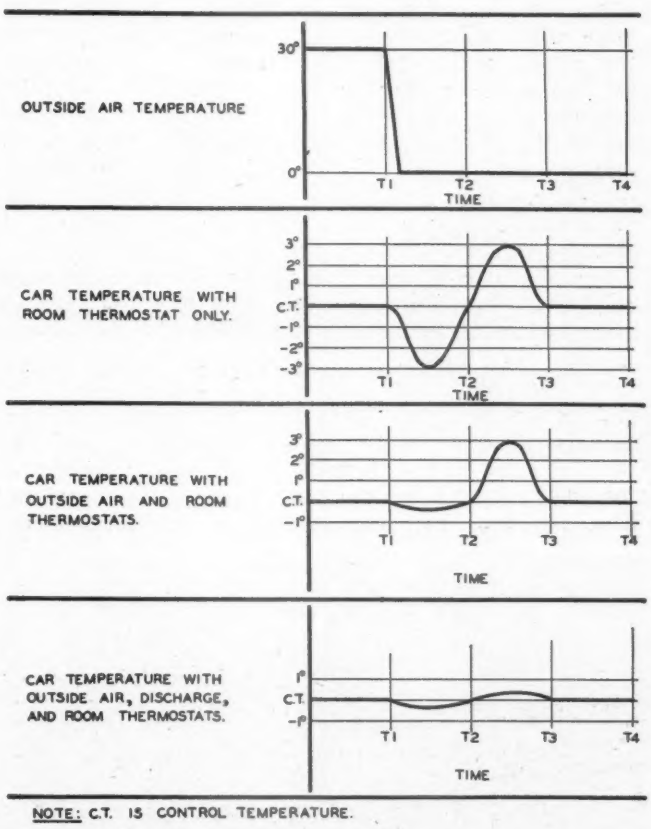
Another factor that must be considered during the cooling cycle is the difficulty of securing cooling with the side-wall surfaces. One problem would be the location of the side-wall surfaces for cooling. Since cool air drops while warm air rises, it would be desirable to locate the side-wall surfaces used for cooling over the windows so the cool air would pass down over the windows and warm wall area. Since the opposite is true in the wintertime, the side-wall surfaces are therefore located under the window. Another problem is the difficulty of distributing refrigerant to the side-wall surface and disposing of the moisture that would be condensed by the side-wall surfaces.

Because of the additional complications encountered when cooling with the side-wall surfaces and because of the reduced need for side-wall capacity during the summer time, the usual solution is to dispense with the use of the side-wall surfaces during the cooling cycle. While the side-wall cooling surfaces would undoubtedly improve the performance of the air conditioning system during the summer time, and equipment for such a system is available, they are normally eliminated on the basis that the small improvement in performance would not always be warranted.

Since the side-wall surfaces do not operate during the cooling season, the problem of cooling control is reduced to the problem of controlling the car space temperature by means of the overhead system. This is accomplished by using the same space thermostat as we used during the heating cycle. An outside air thermostat may be used to anticipate changes in outdoor air temperature just as in the winter time. Ordinarily, however, a discharge air thermostat is not used since refrigeration equipment is usually operated in a two-step manner and therefore, gradual changes in discharge air temperature are not available.

In connection with the control of the cooling equipment, it is also necessary to consider the problem of humidity control. During the winter time, the humidity in a railroad car will seldom be out of the comfort range. During the summer, however, because of the evaporation of moisture from the bodies of the passengers, it is possible for the humidity to become high, causing discomfort due to a damp, clammy feeling. This can be avoided if humidities are kept below 60 per cent relative humidity at all times.

The cooling coil in the overhead system is the only method of reducing the humidity that is ordinarily available in a railroad car air conditioning system. This cooling coil removes excess moisture by reducing the air temperature until this moisture is condensed out on the cooling coil. This also results in a reduction in the air temperature in the car space. Therefore, under humidity demand alone, it would be necessary to



Overhead unit temperature control

overcool the car passenger space in order to reduce the amount of moisture in the air. The discomfort that would be caused by this excess cooling can be eliminated, however, by using the heating coil in the overhead supply to warm the air sufficiently to maintain proper car temperatures. This means that we can maintain proper relative humidity under maximum conditions by overcooling the air and then reheating it with the steam heating coil.

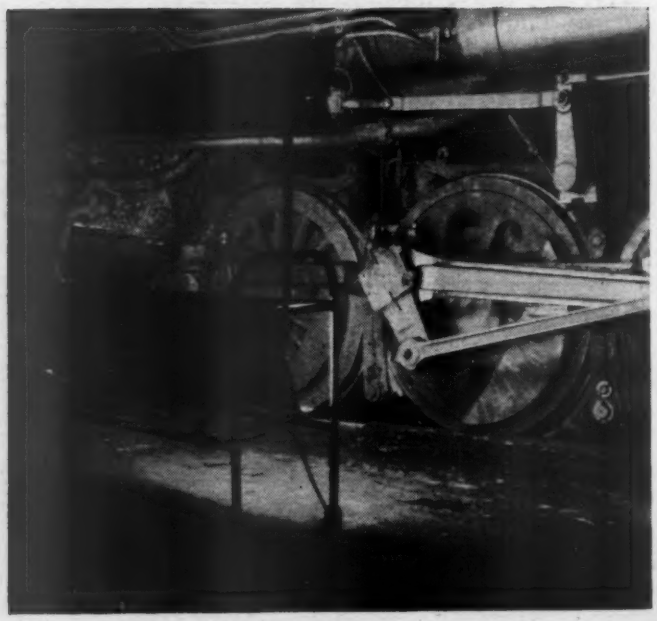
Humidity Control

A special problem that is encountered in humidity control is the selection of a satisfactory humidity controller. For ordinary stationary control applications, the human hair type of humidity controller has been most successful. This humidity controller depends upon the expansion and contraction of human hairs with changes in humidity conditions. This type of humidity controller, however, would be unsatisfactory for railroad conditions. In the first place, it is too

(*Continued on page* 100)

Portable Enginehouse Lights

Erie has developed lighting units mounted on wheels—eight 400-watt units have been found sufficient to light the working areas in a 22-stall enginehouse



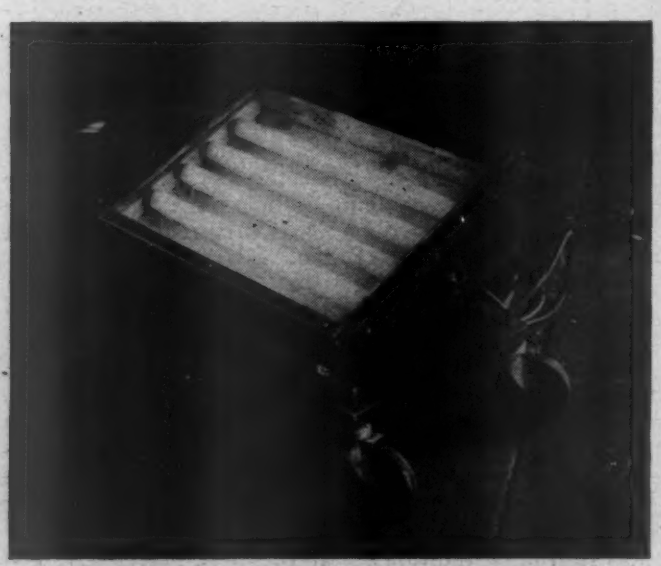
The lights depict details clearly without excessively sharp shadows

THE Erie now has in service about 75 portable lighting units which have been found highly effective in lighting work areas. They are made at Meadville, Pa., and are used at various points on the lines, both in enginehouses and shops. Mounted on wheels, they are rolled to the location where the work is being done. When placed at a distance of 9 or 10 ft. from the side of a locomotive, they supply from 35 to 40 footcandles of almost shadowless illumination over the vertical working plane.

The framework on which the lights are mounted is made of 1-in. rigid metal conduit and is of welded construction. Mounted horizontally on the frame are two lighting units having white enameled steel reflectors. There are two 100-watt fluorescent lamps in each reflector and the auixiliaries are mounted inside the unit. The lower lighting unit is 30 in. above the floor and is tipped up at an angle of about 45 deg. The upper unit is 6 ft. 4 in. above the floor and is adjustable. It may be rotated on its longitudinal axis 70 deg. above or below the horizontal.

The adjustment is accomplished by means of a chain,

The lower lighting unit is in a fixed position in the frame while the upper one may be rotated on its own longitudinal axis—The counterweights relieve the frame of the torque which would otherwise be caused by the upper fixture and also make the unit more stable when it is being moved



"The crawler" was specially designed for pit lighting

two sprocket wheels and a crank. The upper sprocket is mounted on the reflector, and the lower sprocket on a short shaft with a hand crank is mounted on the frame at a convenient height. A chain connects the two sprockets, and connected to the crank is a quadrant having a series of holes near its outer rim. There is a matching hole in the framework and a cotter pin pushed through one of the holes in the quadrant and the

one in the frame will lock the fixture at any desired angle.

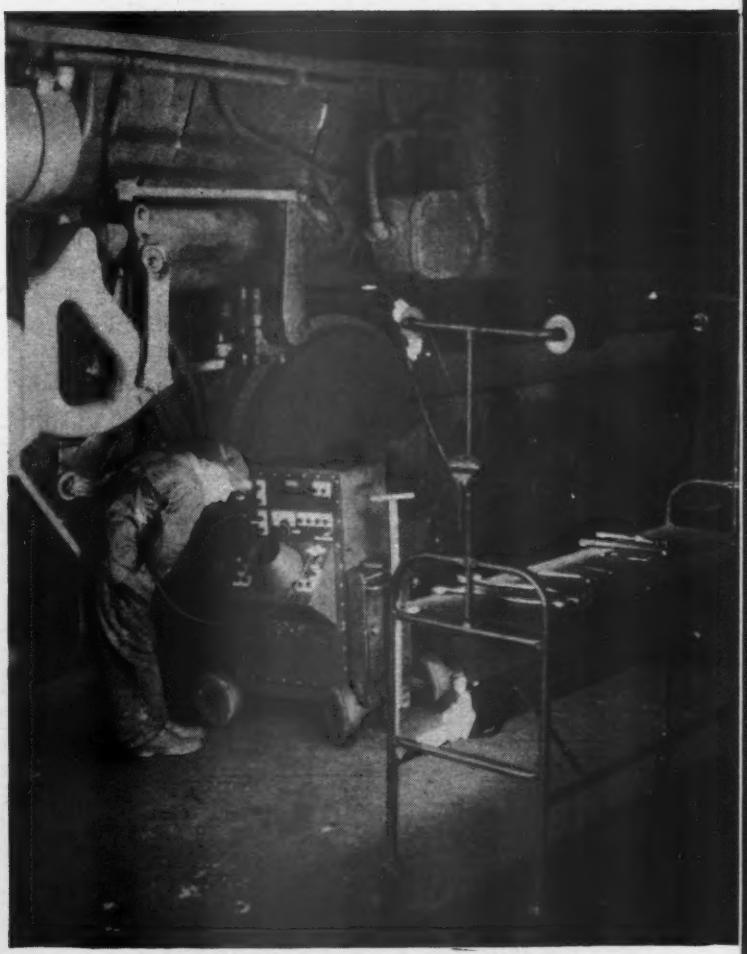
The frame is 6 ft. 4 in. high, 6 ft. long and 2 ft. wide, The rubber-tired wheels of the four casters on which it is rolled, are 8 in. in diameter. A tray for tools 6 ft. by 2 ft. is mounted on the framework at a height of 40 in. from the floor. A 50-ft. length of cord makes it possible to connect the portable unit to outlets originally installed for hand portables or extension lights.

No additional wiring in the enginehouses was necessary, since the current carrying capacity of the existing extension light circuits was sufficient to carry the 400-watt load of the rolling portables. The only other lights required in a steam locomotive enginehouse are aisle

How "the crawler" lights the underside of a locomotive

lights and pit lights. Experience has shown that eight of the lighting units meet the requirements of a 22-stall enginehouse. The lighting units are not charged out, but are picked up by the shopmen from the floor as they are needed. Since they are in a convenient position, it has also been found that the users will wipe off the lamps and reflectors when they get dirty. There has been practically no lamp breakage in a period of more than a year since the first of these units was placed in service.

For pit lighting, another rolling lighting unit, nicknamed "the crawler" was developed. It consists of a metal housing with a shatter-proof clear glass front or top. It is fitted with four, 24-in., 20-watt, fluorescent lamps and a white reflector. It is mounted on a rectangular, angle-iron frame by means of two vertical members at each end of the frame. A stud at each end of the lighting unit rests in a slot at the top of each vertical member and a wing nut on the stud is used to hold the unit at any desired angle. It may be tipped to 20 deg. either side of the vertical. The supporting frame is mounted on four casters having 4-in. rubber-tired wheels.



One of the portable units at Meadville, Pa., being used to light the operation of a supersonic reflectoscope

Chain, sprocket, crank and quadrant for positioning the upper fixture

Axle Power for Passenger Cars

By E. F. H. Grothe*

The ratio of generator and battery sizes to connected load is highly important to most effective performance of the power supply system

FUNDAMENTALLY, a major requirement of power plants on air-conditioned cars is that they be self-sustaining. The degree to which this requirement is met in present practice depends upon the balance between battery and generator capacity, and the total load. The capacity of generator and battery selected largely determines the operating results.

Let us look at the fundamentals. All electrical power used on a car must be provided by the generator when the car is at operating speed; or when a car is at a terminal, by a standby circuit tied in with the local public utility. The battery does not create electrical power; it merely acts as a reservoir which stores power made by the generator or obtained from the standby circuit at terminals. The battery supplies its power en route as needed, much as shown in the illustration.

Many railroad men are of the opinion that there is little difference except *size* in comparing the generator and battery on an air-conditioned car versus a non-air-conditioned car. For the air-conditioned car, more power is required and the generator and battery are larger. However, with this important difference, the reserve power in the generator and battery is less in air-conditioned cars. With non-air-conditioned cars, the generators can deliver from 2 to 2½ times the full connected load in amperes and the batteries can quite often carry the full load from eight to ten hours. For air-conditioned cars, the generator size has been found to be from 1¼ to 2 times the full load in amperes and the battery reserve protection from 1¼ to 3 hours.

Because the reserve generator and battery capacity of air-conditioned cars is so much less, such cars are naturally subject to more failures that can be attributed to the power supply. Since train schedules are faster with fewer layovers, the reserve generator and battery capacity of 15 years ago is not needed with the modern train. However, because of the smaller battery reserve provided on modern cars, there is a greater necessity for providing generator capacity adequate to meet the requirements of modern operation.

The experience of railway engineers in the past provides useful hints for procedures to follow in obtaining adequate generator capacity. In the report of the A.A.R. Committee on Car Electrical Equipment (dated June 7, 1945), it was pointed out that on through-passenger runs the output of the generator, in kw.-hr., will not exceed 65 per cent of its continuous rating. This is due to station stops, slow downs, and the fact that the full load of the car is not always turned on.

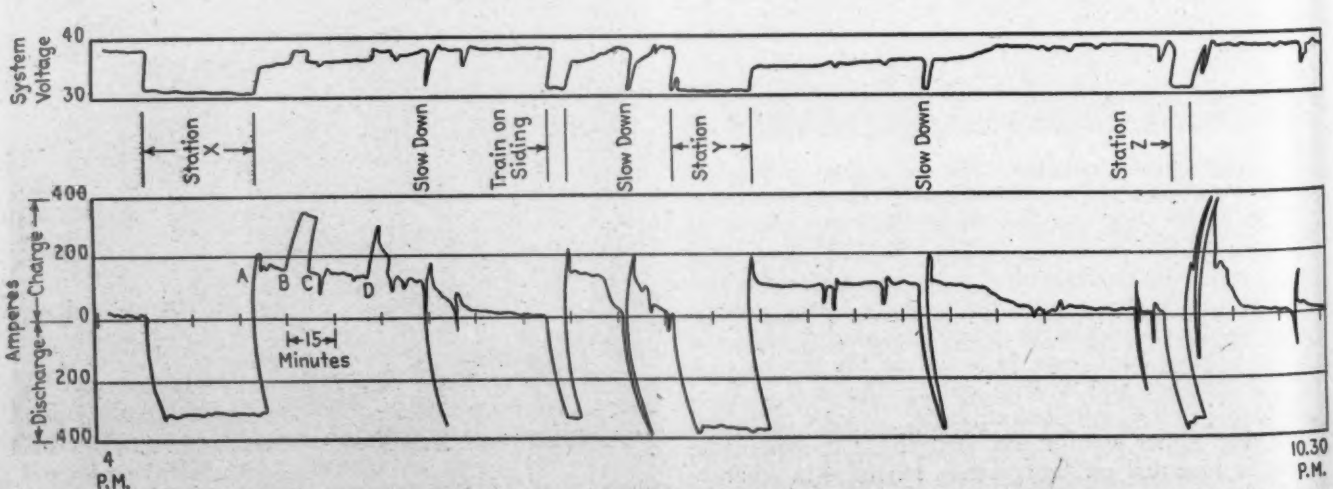
If the full electrical load is to be supplied for an entire run, and if the generator size was selected to be equal to the full load, and with no battery charging included, the division of power could be 65 per cent from the generator and 35 per cent from the battery.

However, the generator must replace the power that the battery supplied and this replacement of battery power must be done at the same time that the full load is on the generator—(this premise is on the assumption that the full load was turned on for the entire run). Consequently, a generator must be chosen which has a capacity greater than the full load in order to recharge the battery. This is essential because the battery must supply power en route, no matter how large the generator might be.

Experience of railway engineers with modern equipment clearly indicates that the optimum capacity in amperes for the generator should be 1-2/3 times the full load. While this is optimum, some adjustment is in order because generators are available in only certain capacities, and it is common practice to select the capacity closest to the size of the load. The optimum size generator can provide the additional current needed when the battery is somewhat discharged. This ability quickly recharges the battery so that its full capacity is available at all times for the reserve protection.

The choice of battery size will be based largely on the reserve protection desired and the space available.

*Engineer, The Electric Storage Battery Company, Philadelphia, Pa.



Typical chart showing how much a battery discharges and charges during an actual run

The battery provides current to supply when standing en route, and when at terminals. With adequate standby facilities at terminals, the battery is relieved of this precooling period load. But even when this standby power is available, the battery still has much work to do en route.

From this brief analysis, it is apparent that the length of time that the battery is required to carry the electrical load will vary widely, and hence no fixed formula can be offered. The experience of railway engineers indicates, however, that a well-balanced system should have a battery capable of providing about three hours protection. With certain cars, possibly longer reserve protection is desirable for all or part of the load. For example, with dining cars, the smaller load of refrigerated food lockers may be needed during layovers, when the larger air-conditioning load might be normally turned off.

To provide a guide in the selection of reserve battery protection, with a fully charged battery, the following table is offered. It gives some idea of the capacities of both generator and battery required to provide a well-balanced, self-sustaining carlighting and air-conditioning system.

Generator and Battery Capacities Required for Various Connected Loads

Total connected load, amperes	Approx. size generator, amperes	Battery size, 8 hour, amp. hr.	Battery reserve protection in hours: 100 per cent load	75 per cent load	50 per cent load	25 per cent load
100	165	588	5.2	7.8	12.8	28
150	250	706	3.8	5.7	9.8	22
200	330	882	3.4	5.2	9.0	20
250	415	1,000	3.2	4.6	8.0	18.5
300	500	1,176	2.9	4.4	7.8	18
350	580	1,294	2.6	4.0	7.2	16.8

In this table, and in the preceding discussion, the electrical load and generator size is expressed in amperes. This is done for simplification of presentation, and to show that the voltage of the system, that is, 32 volt, 64 volt, or 110 volt, is unimportant from the viewpoint of what a well-balanced system should be with regard to generator and battery sizes.

CONSULTING DEPARTMENT

Effect of Induction on Cable Sheaths

Would the lead sheathing on a single-conductor lead-covered cable cause any heating due to induction if three single-conductor cables were used for supplying a three-phase motor?

Effect Can Be Controlled

Yes, because a single-conductor leaded cable carrying alternating current comprises within itself all of the elements of a transformer. However, the losses which may result are quite small for light loads and may be controlled for heavier loads by operating the lead sheath open-circuited. An explanation of how these losses may occur will help to clarify how they can be controlled.

The conductor of a single-conductor lead-sheathed cable carrying an alternating current acts as the primary. The lead sheath acts as the secondary, and the alternating magnetic flux, which is set up whenever the current flows, links the conductor and the sheath, thereby inducing voltages in the sheath.

If the sheaths of the three single-conductor cables comprising the three-phase circuit are bonded together and grounded at this one point only the induced voltage will appear as voltage to ground, and the magnitude of the voltage will be directly proportional to the distance of the point under consideration from the ground connection.

If, however, more than one bond is used between the sheaths of the three cables along this length, the sheath voltage is short-circuited and a circulating current will travel along the sheath of one cable and return along the sheaths of the others. It is this circulating current that gives rise to an I^2R loss which produces the additional heating referred to in the question. These circulating currents are, of course, proportional to voltages induced in the lead sheaths and can become quite excessive for large size cables which carry heavy loads. For instance, in large cables carrying many amperes, these sheath losses may amount to as much or more than the I^2R loss in the copper conductor.

The calculation of these losses is a complicated procedure requiring excessive mathematical computations.

Can you answer the following question? Answers should be addressed: Electrical Editor, Railway Mechanical Engineer, 30 Church Street, New York 7.

On dismantling a 20 hp., squirrel cage, three-phase induction motor for the annual overhaul, we discovered that several of the rotor bars and end rings were broken. The motor had been operating satisfactorily. What caused these breakages and how can we stop their recurrence in the future?

Table I, computed for 3 and 5 kv. oil-filled cables illustrates how large they can be. It is realized that the problem stated is for a much lower voltage, but the percentage reduction in current carrying capacity is comparable for a low voltage cable.

Table I—Current Carrying Capacity Open-Circuited Vs. Short-Circuited Sheath Operation

Conductor size in AWG or 1,000 cm.	Amperes, open-circuited sheath	Amperes, short-circuited sheath
0	256	238
00	287	270
000	320	285
0000	378	327
250	405	343
300	450	372
350	492	397
400	528	420
500	592	457
600	655	487
700	712	513
750	742	525
800	767	535
900	822	553
1,000	872	568
1,250	990	603
1,500	1,082	628
1,750	1,165	650
2,000	1,240	670

Note: These values are based on single-conductor 34.5 kv. oil-filled leaded cable with one cable in a duct with 7½-in. spacing between the ducts and a 75 deg. C. copper operating temperature.

It should be noted that the losses for small sizes of cables are quite nominal. In fact, the reduction in current carrying capacity is only 11 per cent for a 3/0 AWG cable, yet rises to 46 per cent for a 2,000,000 circular mil cable.

The control of these circulating-current losses encoun-

tered with single conductor leaded cables is accomplished in several ways. In the first place, these losses are not excessive for light loads. In the second place, they do not become excessive unless the cables become so large that the individual single conductor cable must be installed in separate ducts or conduits. The induced voltages in the lead sheaths which produce the circulating currents are dependent upon the spacing between the conductors. The closer the spacing, the lower the induced voltage. For example, if three single-conductor cables were twisted together, the spacing would be reduced to approximately that of a three-conductor cable and the losses would be but slightly higher. While this condition is not quite as good for the commonly used type of installation (three single-conductor leaded cables pulled parallel into a duct or conduit) here the same effect of close spacing prevails and the losses remain reasonably low; but, when single-conductor leaded cables must be separate and are installed in individual ducts or conduits, these circulating currents should be eliminated or reduced to where the losses become small. This can be done in two different ways.

The circulating-current losses may be eliminated by the introducing of insulating sleeves at various points along the lead sheath, the sheath being grounded on one side only of each insulating sleeve. Sheath voltages will then take the place of sheath currents and the circulating-current losses are eliminated.

This method is sometimes objectionable due to the magnitude of the voltages built up; for although they cause no appreciable losses, they are somewhat active in supporting and even initiating electrolytic action. In this case, a compromise may be reached by certain special forms of bonding, or by the use of bonding transformers or impedances. The use of these devices limits the voltage by permitting a certain amount of circulating-current to flow but limits the I^2R sheath loss by keeping this current down to a reasonable value.

L. L. YOUNG,
Wire & Cable Division
General Electric Company

Single-Conductor Cables May Require Special Consideration

When an alternating current flows along a conductor, a magnetic field is set up around it as the intensity of current varies from zero to a maximum value in either direction. When a conductor, such as the sheathing on a lead-covered cable, is interlinked with a magnetic field whose intensity alternately builds up to a maximum and collapses, an e.m.f. is set up which causes a current to flow in the sheathing if the circuit is completed. The direction of the induced e.m.f. and current flow are at right angles to the magnetic field or along the sheathing. In this case, if the steel cabinets or other terminal fittings at the two ends of the single-conductor lead-covered cables provide the necessary metallic interconnection of the three sheaths to complete the electrical circuit, induced currents will flow along the three sheaths. These currents may raise the temperature of the sheathing to a point where injury to the cable insulation may result. This loss of heat energy may also cause an objectionable voltage drop.

Somewhat similar conditions prevail when the open, single-conductors of a three-phase circuit enter a steel trough in back of the switchboard through individual holes.

In order that the e.m.f. produced by the induced current in one conductor may almost completely be neutralized by the effects of the others, all conductors of a circuit should be placed in the same sheathing or other metal enclosure. In this case, if a three-conductor, lead-sheathed cable is not available, a conduit containing the three conductors of the circuit should be used. If the three-conductor, lead-sheathed cable available is not of ample cross-section, the cable may be paralleled, provided that the ends are connected together in such a way as to make contact resistance negligible and at least one wire of each phase is carried in each cable. If the lead sheathing of the cable is removed before entering a metal trough, the wires of the motor circuit should enter the trough through one opening.

Observing the foregoing precautions will tend to reduce inductive effects and heating of cable sheathing or other metal enclosure caused by induced currents.

R. G. CAZANJIAN

Basic Requirements of Car Heating and Cooling

(*Continued from page* 95)

delicate to stand the vibration encountered in railroad service. Also, it is important that the hair element be kept clean in order to secure proper performance, and this would be impractical on a railroad car installation. Even at best, under ideal stationary application conditions, the human hair type of humidity controller is not very sensitive and tends to change its calibration over a period of time.

Fortunately, there is a humidity sensitive control element which is available for use with a Wheatstone bridge and amplifier controlling means. This humidity sensitive element consists of a dual winding of wire on a plastic surface which is coated with a moisture sensitive compound. The resistance between the two metal wires depends on the moisture content of the coating compound. The moisture content of the coating compound varies with the relative humidity of the surrounding air so this resistance becomes an accurate measurement of the relative humidity of the surrounding air. This variation of resistance can be used in the Wheatstone bridge just as the variation in resistance of the thermostat was used. This type of humidity controller can respond instantly to changes of humidity and has a sensitivity sufficient to detect changes in relative humidity as small as 0.5 per cent. Especially important is the fact that this type of humidity element has a high degree of stability and is not affected by the vibration or appreciably affected by dirt encountered in railroad applications.

This humidity control is applied in the railroad car air conditioning system in such a manner that the refrigeration equipment is operated at a higher capacity than required by cooling whenever this high capacity is required in order to reduce excess relative humidity. In this case, over-cooling of the car is prevented by the action of the standard heating control system which reheats the air by means of the heating coil in the overhead system. This gives control of humidity as well as temperature so as to maintain comfort in the car under all conditions.

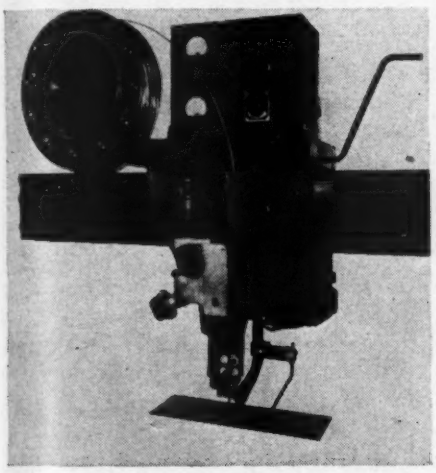
The drawing shows a typical application of this complete control system to a coach. For the purposes of illustration, the circulating liquid type of side-wall heating is shown, since this allows the best control of heat output. Note that the use of a single space thermostat permits accurate automatic changeover from heating to cooling, when required, without any danger of overlap of the two operations. The extreme flexibility of this electronic system makes possible the operation of the complete air conditioning control system by a single on-off switch, and relieves the train personnel of any responsibility for adjusting temperature control systems to various conditions.

NEW DEVICES

The Hidden-Arc Process of Welding

The Lincolnweld hidden-arc welding process may be used in welding all types of joints including butt, lap, tee and fillet as well as corner. The process is designed for use with direct current, utilizing a bare metallic electrode which is fed through a granular flux deposited on the joint to be welded. Sufficient flux is applied to blanket the arc and the molten metal completely; the unfused flux is then reclaimed for further use.

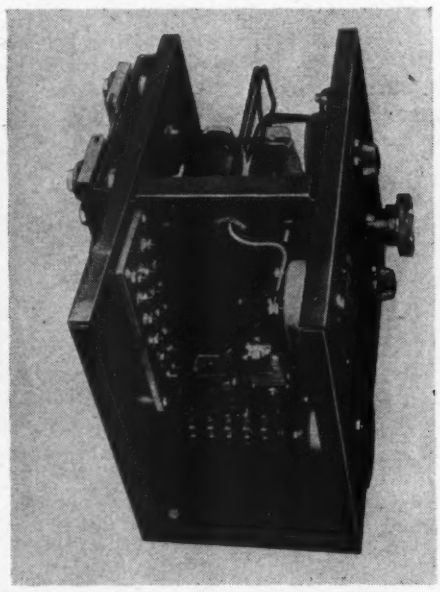
Direct current is employed because it offers simplified and positive control, the ability to weld non-ferrous metals, and control of the electrode melting rate through the option of either straight or reverse polarity. Extremely high current densities are used, ⅛-in. electrodes carrying as much as 650 amp. This produces deep penetration and permits a small cross section of weld metal with a resulting saving in cost and reduced warpage and distortion. The process is also said to be less sensitive to scale and moisture than conventional automatic welding methods. This eliminates or reduces plate cleaning prior to welding. In extreme cases of scale, buffing with a power wire wheel usually provides sufficient edge cleaning, whereas grinding and sand-blasting might have been required formerly.



Welding head, complete with flux hopper, wire reel and control, mounted on a motor-driven carriage—The head may also be mounted on a portable tractor unit

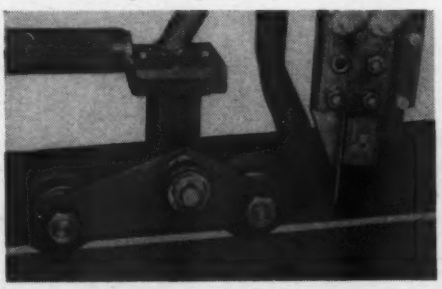
With this process one type and grade of flux, together with one analysis of electrode, can be used with the same procedure for a wide range of steel analyses. For example, ingot iron and steels up to .40 per cent carbon can be welded with the same procedure. Thus, special joint preparations, and the changing of flux, wire analysis and welding procedure are eliminated.

The equipment will take ⅛-in. to 7/32-in. electrodes without changes of drive rolls, wire contacts or control. The control is simple and quick acting; there are no vibrating relays or electronic devices. The electrode will feed in either direction by controling the wire motor through a special exciter. The automatic control box contains the current, arc-voltage, and travel-speed rheostats in one compartment and the ammeter, voltmeter and two contactors for the operation of the equipment in the other compartment. This gives the operator quick and easy control over voltage, current and speed when changing from one job to another.



The interior of the control box of the Lincolnweld automatic welder

The welding head is normally used in conjunction with a specially built automatic welding set of 1,200 amp. capacity. The current rheostat in the automatic control box permits a current range of 300 to 1,200 amp. The unit has two exciters, one for the automatic head control and one for the welder field excitation. The welder control box has provisions for easy and quick wiring of the automatic.



A roller guide for a Lincolnweld tractor showing the rollers in the butt joint of the work

The welding head, with flux hopper, wire reel and control may be mounted on a motor-driven carriage or on a portable tractor unit. A pointer is used for following irregular seams in square butt welding. For prepared joints, roller guides are used to engage the seam.

The standard head is changed from butt to fillet welding in a matter of only a few minutes. In making fillet welds the lower wire guide and flux tube are changed from straight to curved, thus permitting the head and wire reel to be left in its normal position. The wire is fed in at 40 deg. from the horizontal which gives the maximum effective throat for horizontal fillet welds.

This process was developed by the Lincoln Electric Company, 12818 Coit road, Cleveland 1, Ohio.

Cutter and Tool Grinder

The latest model of No. 2 cutter and tool grinder built by the Cincinnati Milling Machine Company, Cincinnati 9, Ohio, features dual hand table-traverse knobs, traditionally located at the rear of the machine, which are now duplicated at the front. This gives the operator table-traverse control at every possible operating position—at the front, right- and left-hand corner of the bed; behind the table, and from the right- and left-hand side of the bed. Versatility of the machine in grinding large cutters, especially those which are mounted on the face-mill grinding attachment, is attained by the large 10½-in. vertical adjustment of the grinding-wheel head.

In addition to the attachments available for these machines, such as face-mill grinding attachments, long reamer grinding attachments, spring collets, etc., two types of wet-grinding attachments are now available. One is for cylindrical grinding operations. It incorporates a motor-driven pump and tank unit, built into the machine base, and includes splash guards around the table and wheel. The other attachment, separate from the machine, is for carbide grinding operations. A motor-driven coolant pump and tank and an air-suction pump are combined into one unit. A thin stream of coolant, directed to the wheel, is disintegrated into tiny drops by the revolving wheel. The air suction returns the moisture to the tank, keeping the table and machine dry while the wheel and work are clean and cool.

The table slide and saddle are fitted with hardened and ground ways, separated by hardened, matched balls. A ¾-hp. motor, mounted on the lower end of the wheelhead column, drives the grinding-wheel spindle through the medium of an endless flat belt. To exclude dust, the wheelhead column is

encased by an accordion-type rubber guard. Vertical adjustment hand wheels on both sides of the bed facilitate the grinding of right- and left-hand cutters, and cross adjustment hand wheels at the front and rear aid the operator in setting up the machine.

Electrical controls are built in a recessed compartment at the front of the machine. A disconnect switch, operated by the latch handle on the

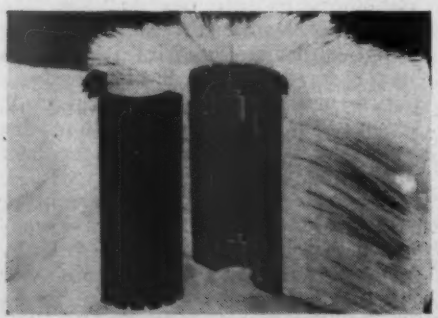
The latest model Cincinnati No. 2 cutter and tool grinder features hand table-traverse knobs at both the front and rear of the machine

electrical compartment door, shuts off the current when the door is opened. Additional safety will be found in the transformer unit included with the controls for shops operating on high voltages. It reduces the voltage to 110 at the push-button station. Push buttons also are built-in. They consist of start-and-stop buttons for plain and universal machines; in addition, universal machines are equipped with a two-way switch for the cylindrical grinding-attachment motor.

Train Washing Rotary Scrub Brush

A rotary scrub brush for use with mechanical train-washing equipment that cleans cars at the rate of one per minute is made by the Whiting Corporation, Harvey, Ill. In this method of washing trains, these rotary scrub brushes whirl into action as the train passes through the installation. Jets of cleaning solution spray the cars, then additional brushes and a cold shower give the train a final shine.

The cores of the revolving brushes are molded from Bakelite phenolic molding material. These plastic cores are reported to simplify maintenance problems since they are designed to be completely weatherproof, mechanically strong, and long lasting. It is said that bristles stay in these cores longer and that greater control over the density of bristles may be maintained.



Rotary scrub brush for mechanical train cleaning has a Bakelite core

Refrigerator Car Heater

An automatic heater to protect winter shipments of perishable goods in refrigerator cars and which combines safety and efficiency with unattended operation for more than two days at a single filling has been introduced by Preco Incorporated, 960 East Sixty-first street, Los Angeles 1, Calif.

Preco automatic refrigerator-car heater

The Preco automatic heater, using methanol, has a burning rate of 6,000 B.t.u. per hr. and is equipped with a rugged, built-in thermostat which is adjustable for any temperature from 30 deg. to 60 deg. F. Fuel capacity is 5¼ gal.

Among its unique safety features is the heater's explosion-proof design with the flame located *above* the fuel level. A fiberglass wick raises fuel to the burner and in turn acts as a safety valve. The heater is built with a wide base and low center of gravity to prevent upsetting and all surfaces of the tank are smooth and slope away from the flame area for additional protection. The heater is constructed throughout of heavy-gauge steel and is completely protected against corrosion.

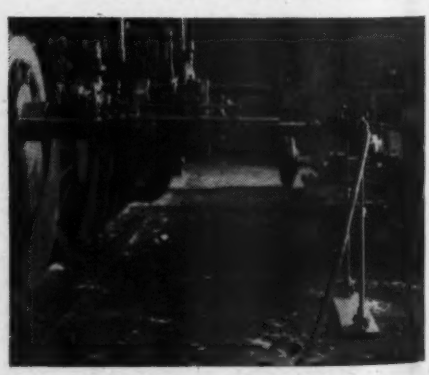
The heater is simple in construction and operation, consisting of only four interchangeable assemblies, the tank, thermostat, wick and chimney units. It is 15¾ in. in diameter, 23½ in. high, and weighs 35 lb. empty and 70 lb. when full. The tank bottom is recessed to permit easy stacking.

Portable Crank Pin and Journal Turning Machine

The Marsh portable turning and grinding machine is designed to re-turn and finish by grinding in place end journals on trailer axles and crank pins on steam locomotives. It will turn diameters from 4 in. to 12 in. and lengths up to 20 in. The machine is a self-contained unit including a stationary spindle and a rotating cylinder which has a sliding tool bar equipped with automatic and reversible gear-driven feeds. The heads for the turning tools and the grinding wheel are detachable. The machine weighs 450 lb. and is driven by an air motor supported at any desired height by an adjustable stand.

The rotating cylinder revolves on a stationary sprindle and has tapered adjustable bearings to compensate for wear. The drive is by alloy-steel gears enclosed in a grease-tight case. The sliding-tool bar bearings are located on each end of the rotating cylinder and are adjustable for wear. The feed gears are built into the revolving cylinder.

The spindle is tapered and adjustable for wear and is fastened or clamped to the end of a crank pin, trailer axle, or shaft by an adapter. One end of the adapter is fastened to the end of a crank pin or trailer axle; the other end fits into the end of the machine spindle. The adapter connection to the crank pin is clamped by a bolt, stud, or nut on the threads used to hold rod collars on the end of the pin. The adapter connects the turning machine to any style or type



The Marsh machine with the turning head removed and the grinding head attached to finish grind a crank pin

crank pin or end journal without the aid or use of measuring tools.

The sliding-tool bar is 2¼ in. in diameter, made from chrome-nickel steel. It has a traverse-feed movement of 20 in. and can be had with a longer travel if desired. Fine or course feed in either direction is furnished by a gear-driven

The Marsh portable turning and grinding machine rough turning a main crank pin—The same machine finishes the pin by grinding

reversible feed. The turning head uses high-speed-steel tools to cut and remove uneven off-center wear from rough, cut or burnt crank pins, trailer axles or shaft journals. A hand-operated rapid traverse moves the tool bar to a cutting position or withdraws it at the end of a cut. A hand-operated screw-down feed feeds the tool into the work.

The detachable grinding head is mounted on the end of the tool bar in the same place as the turning head when the turning head is detached. A 2-hp. air motor built into the head drives the grinding-wheel spindle. The grinding head has an auxiliary sliding bar which connects the grinding head on the tool bar with an adjustable connection to change the grinding wheel from a 4-in. to a 12-in. diameter cutting surface. The grinding wheel is also provided with a precision hand feed to feed the grinding wheel into the work. The auxiliary sliding-bar support has automatic feed stops that can be seet to stop the grinding-wheel feed at any desired point. Compressed air is supplied to the air motor in the grinding head through an air collector located on the end of the stationary spindle. From here it flows through a telescoping pipe line to the air motor as the head feeds out with the revolving cylinder.

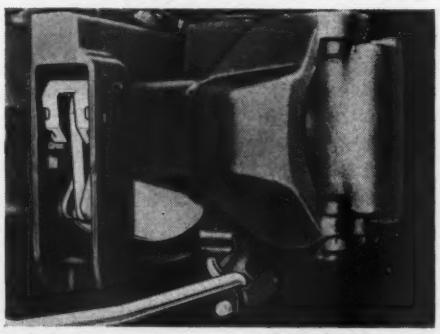
The portable turning and grinding machine is a product of C. E. Marsh, P. O. Box 289, Atlanta, Ga.

Coupler Height Adjuster

The Standard Railway Equipment Manufacturing Company, Chicago, has recently developed a coupler height adjustment in combination with a centering device.

The centering device itself utilizes the same carry iron and links as have been used on over 1½ million freight cars. It furnishes a strong but flexible support for the coupler shank, and automatically returns the coupler to approximately the central positiou whenever the car is uncoupled.

The coupler height adjustment is achieved through the utilization of rotatable trunnions. These trunnions rest on supports which are made integral



Standard centering device with coupler-height adjustment

with the striker whether it be welded or cast. The coupler carrier links are hung from the rotatable trunnions in any one of four positions allowing adjustment when necessary by rotating both trunnions to any one of the various positions. The hole in each trunnion is off center so that the second position raises the coupler carrier ¼ in., the third position raises the coupler carrier ⅜ in. and the fourth position raises it ½ in.

This eliminates the need of ¼ in., ⅜ in. and ½ in. shims. The accompanying drawing, illustrating the support of the coupler, indicates how an adjustment of the coupler carrier is amplified about three times at the knuckle face.

Cleaning Fluid for Vapor-Type Cleaners

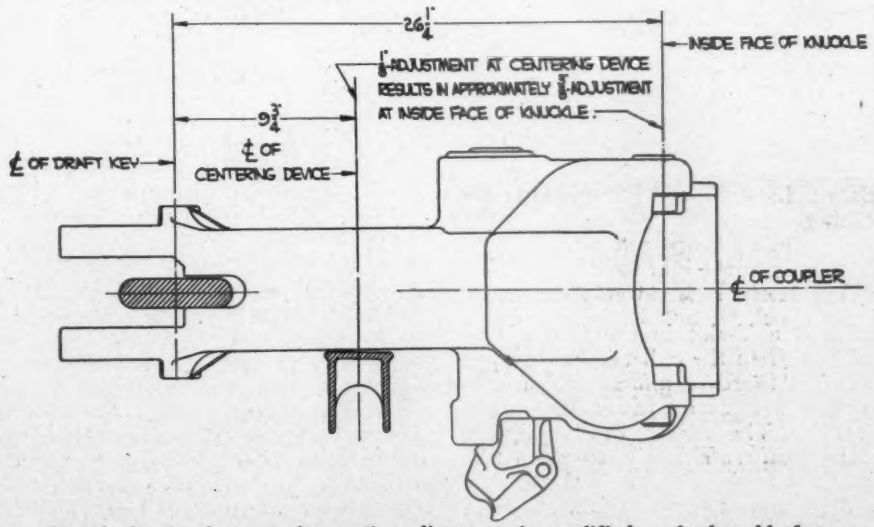
Two liquid cleaning materials are being offered to users of steam-gun and vapor cleaning equipment by the Magnus Chemical Company, Inc., Garwood, N. J., one for light-duty cleaning and one for heavy-duty cleaning.

With the liquid vapor cleaner there is no lost time waiting for the cleaner to dissolve. It is instantly and completely soluble in cold water, and does not require premixing in hot water before adding to the machine. Either of the two cleaning fluids can be stored for long periods without deteriorating and can be dispensed and measured out from a drum by simply opening the faucet.

Both 92-K for light-duty cleaning and 94-K for heavy duty cleaning are clear, colorless, viscous-concentrated alkaline cleaners. As they are odorless and fumeless, they may be used indoors without disagreeable effect upon the person doing the cleaning. Both are compounded to give completely satisfactory results in any make of steam or vapor cleaning machine.

Heavy-Duty Squaring Shears

The rated capacity of the No. 1214 heavy-duty underneath-drive squaring shears developed by the Niagara Machine and Tool Works, Buffalo, N.Y., is ⅝-in. mild steel 14 ft. long. The power shears have a rectangular box-section bed and a triangular box-


26¼"
INSIDE FACE OF KNUCKLE
¼" ADJUSTMENT AT CENTERING DEVICE RESULTS IN APPROXIMATELY ¾" ADJUSTMENT AT INSIDE FACE OF KNUCKLE
9¾"
℄ OF DRAFT KEY
℄ OF CENTERING DEVICE
℄ OF COUPLER

Sketch showing how coupler-carrier adjustment is amplified at the knuckle face

section crosshead to give rigid support to the knives. This rigidity, together with the low slope of the upper knife, reduces the tendency for the sheared pieces to twist, curl or camber.

The holddown, driven by eccentics on the heat-treated crankshaft, needs no auxiliary operating mechanism. Its self-contained, individually spring-

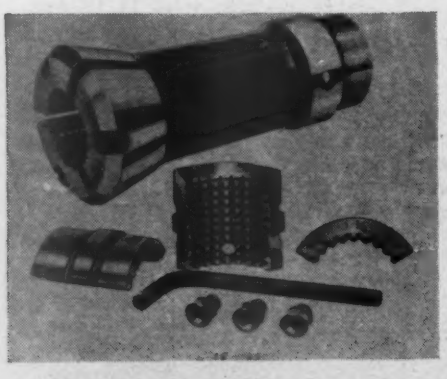
Niagara squaring shears with a capacity for 5/8-in. mild steel up to 14 ft. long

loaded feet clamp the metal during the working part of the cycle and automatically compensate for variation in metal thickness. The parallel ball-bearing self-measuring back gage can be arranged for either manual or electric operation. When motor-driven, it is equipped with a direct-reading indicator located in the crosshead. The wide and narrow push buttons are located in positions on the frame convenient to the operator.

All rotating parts, including the Niagara 14-point-engagemtnt sleeve clutch, the heat-treated gearing and connections, are totally enclosed and operate in a bath of oil.

Master Collet

In the style SM master collet, manufactured by the Sheffer Collet Company, Traverse City, Mich., the pads may be changed without removing the collet from the spindle. The pads are positively held in place by means of a standard socket set screw that



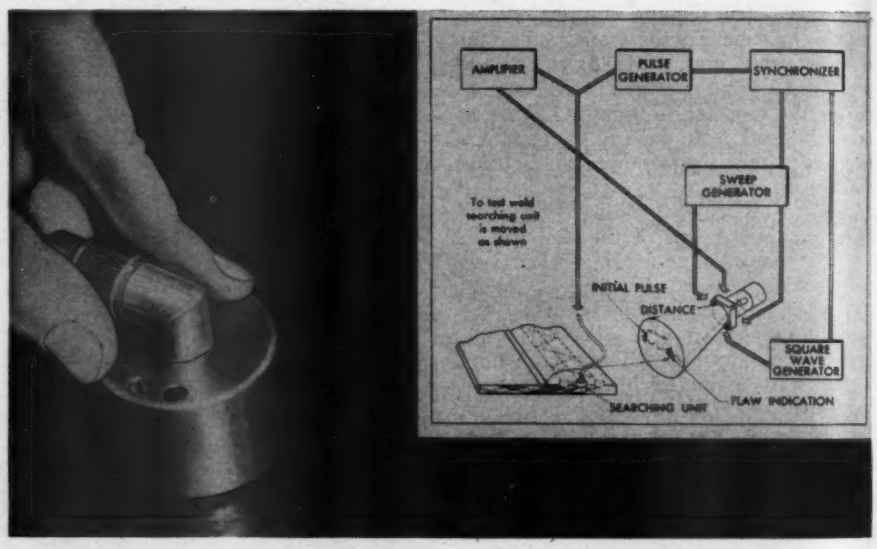
The Sheffer style SM master collet

locks in a T-slot in the face of the collet. When the collet is in the open position, there is sufficient clearance to insert a standard socket screw wrench. The screw need only be backed off sufficiently to drop the shoulder on the pad out of the groove in the collet jaw, and it will slide out of the T-slot, permitting the pad to be removed from the spindle nose.

There are no special locking members of any kind to get lost or damaged and, because there is no wedging action to set up internal strains in the head of the collet, breakage from this cause is eliminated. With one set of master collets any size or shape can be handled up to the full machine capacity by inserting the proper pads. Pads are interchangeable among all makes of machines of one-inch capacity and over.

Weld Testing With Sound Waves

Welds in ferrous metals and light metals can be inspected for lack of bond, inclusions or voids by means of a newly developed testing technique employing high frequency sound waves generated by a Supersonic Reflectoscope. (The Reflectoscope which is made by Sperry Products, Inc., Hoboken, N.J., was described in the June, 1946, and December, 1947, issues of *Railway Mechanical Engineer.)*



The searching unit as applied to a weld and schematic diagram showing the course of the sound waves and the oscilloscope indication

The method is known as angle-beam transmission and makes possible the entrance of the sound beam into the welded part at an angle. The searching unit, whose primary element is a quartz crystal, can be placed on the smooth parent metal adjacent to the weld, or even at some distance from it. The energy travels by successive reflections between the surfaces of the material until an interface is reached. The weld metal itself will not constitute a reflecting interface, but any voids or inclusions will reflect part of the sound beam back to the searching unit where it will be amplified to provide a vertical deflection of the horizontal trace on an oscilloscope screen. A time marking system allows accurate calibration to determine the distance from the searching unit to the flaw, and it is thus possible to distinguish between any defects in the plate and those in the weld area.

The manufacturer states that with the Supersonic Reflectoscope, it is possible to locate smaller defects at greater depths than with X-ray or other non-descructive testing equipment. Also, by controlling the sensitivity of the instrument, defects or voids too small to affect the efficiency of the weld can be by-passed.

Since sound waves travel equally well in aluminum and magnesium as in ferrous metals, welds in light metal plate and sheet stock can also be inspected. Depth of penetration in these metals is comparable to that in steel and defects of the same small size can be located if desirable.

Cleaning and Deodorizing Chemical

A chemical material possessing the dual ability to clean and deodorize in a single, simultaneous operation has been announced by Oakite Products, Inc., 22 Thames street, New York 6. The material, known as Oakite Di-Sanite, is a fine, free-flowing powder, mildly alkaline, that is readily soluble in hot or cold water, and which is said to possess pronounced wetting, penetrating and detergent ability, as well as deodorizing action. The material is safe to use, free from abrasives and harmful ingredients, and its solutions may be applied on surfaces simply by sponging, wiping or mopping.

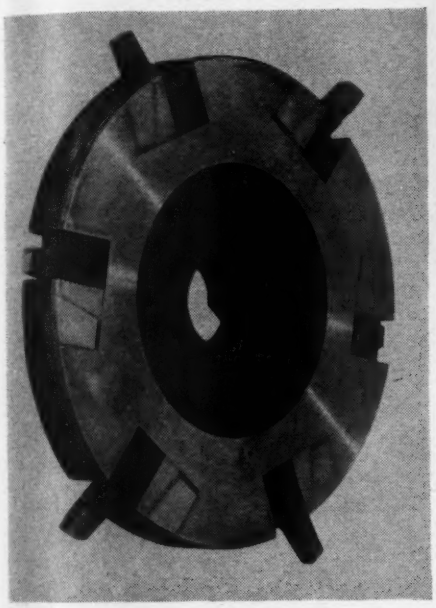
Oakite Di-Sanite is said to be highly effective in destroying objectionable odors at the source for deodorizing toilets, shower stalls, wash and locker rooms; and for cleaning and removing odors from the interiors of public conveyances, such as railroad coaches and other equipment.

This is the second material combining both cleaning and deodorizing action to be developed by the Oakite organization during the last three years. The first of these, Oakite Tri-Sanite, was specifically developed for

use where germicidal action as well as cleaning and deodorizing ability is required.

Flycutter and Face Mill

A series of flycutters and face mills made to fit the conventional arbors and the standard American spindle-nose drives of milling machines is available from the Kendall Corporation, 2361 North Twenty-ninth street,



The Kendall flycutter and face mill

Milwaukee 10, Wis., in 6-, 8-, and 10-in. sizes. The cutter is designed to handle such milling operations as fly cutting, slotting, surface milling, straddle milling and form milling.

Hexagon-shaped holders are used to permit angular setting of tool bits and a positive locking means is incorporated to maintain this setting. The angular setting of the holder is maintained when the tool bit is removed for grinding. Positive clamping of the tool bit in the holder is accomplished by means of a tapered spacer, clamping wedge and clamp screw so located in the cutter body that it is claimed to receive no shearing stress.

The cutter body is made of heat-treated steel. Each of the separate tool bits may be ground and individually positioned to do a portion of the job, thus combining a number of complicated cuts in a single operation.

Auxiliary Tool Unit

A machine tool unit that may be combined with a wide variety of standard machine tools to add the functions of precision milling, drilling, boring and grinding is being produced by The Versa-Mil Co., 30 Church St., New York 7.

The unit may be mounted on the compound or carriage of a lathe, where

End milling a shaft on a lathe by use of the Versa-Mil

it will perform such diverse operations as milling keyways, faces, splines, gears and threads; drilling, reaming, boring, routing; grinding, external and internal, cylindrical, taper and flat surfaces, and tool grinding. It is adapted for mounting on 12-in. to 36-in. lathes. A Versa-Mil and a lathe will substitute for other more costly machine tools, or supplement overloaded tools, balancing out the shop load.

With other machine tools, such as planers, boring mills, horizontal millers and turret lathes, the tool unit will eliminate handling time and simplify set-up, as the work piece may be retained on a single machine for a series of operations including milling, boring and grinding. For example, large castings mounted on a planer may be planed and then milled, drilled and ground without moving from the planer bed. The delays of waiting for additional machine tools to be free are avoided.

In its simplest forms, the basic or power unit, equipped with either a ½-hp. or ¾-hp. motor has spindle speeds from 33 to 295 r.p.m. for milling, drilling, boring and facing. The power unit is 16½ in. high, has a steel base 6 in. by 6¼ in., and weighs 89 lb. to 104 lb., depending on the motor. With a ½-hp. motor, it will mill a ¾-in. by ⅜-in. slot in steel at a rate exceeding 1 in. per minute.

Other units are combined with the power unit for additional machining operations. Interchangeable milling and drilling heads offer speeds up to 5,175 r.p.m. and 360 deg. of angular settings. Grinder heads equip it for cylindrical, surface and internal grinding and for tool grinding. Grinder speeds range from 4,140 to 13,800 r.p.m., with capacities from 6-in. down to 1-in. diameter wheels. A dividing head will index lathe spindles for milling gears and splines or positioning work for graduating, indexed drilling and angular facing.

The Versa-Mil also serves as a portable machine tool that can be taken to large, heavy or stationary work. A feed table, or auxiliary base, incorporates longitudinal and cross feeds, with micrometer lead screws, and provides a means for rigidly mounting on machinery or work surfaces. Keyways and faces can be milled, holes drilled and bored, and shafts and flat surfaces ground without the necessity of disassembly and moving the work into a machine shop. The unit is built to close precision machine-tool standards, incorporating micrometer lead screws, precision bearings, hardened and ground steel wearing parts and oil seals for protection of moving parts from abrasives and coolants.

The Versa-Mil, mounted on a planer, is performing a drilling job

Power Sweeper

A high-speed power sweeper, equipped with a 36-in. revolving brush and vacuum dust control, that enables one man to sweep up to 44,000 sq. ft. of floor per hour has been developed by the G. H. Tennant Company, 2530 North Second street, Minneapolis 11, Minn. The sweeper has a self-starter, drives like a car, and is powered by a 6-hp. air-cooled gasoline engine. It is said to be able to pick up dust and litter at speeds from 4 to 6 m.p.h., and to be useful where salvage of sweepings is desired.

The main feature of the sweeper is its combination revolving brush and vacuum system for picking up soilage. The 36-in. steel or fiber brush revolves inside of a vacuum-equipped compartment that seals to the floor by a snug-fitting flexible rubber skirt. As the brush revolves at high speed, it tosses litter and heavy dust and debris forward into a 9-cu.-ft. removable dirt hopper. At the same time lighter dust, which would ordinarily rise in high clouds because of the speed of the sweeper, is sucked from the top of the

brush compartment into a double-envelope fabric bag.

A single foot pedal controls forward or reverse motion; another serves as a foot throttle. The removable brush "floats" on the floor, and is raised or lowered by a convenient lever.

Power Sweeper that drives like a car and enables one man to sweep over 44,000 sq. ft. of floor per hour has a 36-in. fiber or steel-wire brush that revolves inside of a vacuum-sealed compartment

Self-Operating Portable Spot Welder

A completely portable and self-operating spot-welder that weighs 23 lbs. and welds up to ⅛-in. combined thickness of metal is available from the Greyhound A. C. Arc Welder Corporation, 606 Johnson avenue, Brooklyn 6, N.Y. It was developed for welding jobs in hard-to-get-at places and for outside repair jobs which cannot easily be carried into the shop.

Called the Greyhound portable spot-welder, the self-operating unit is enclosed in a non-corrosive cast-aluminum casing with an integral aluminum handle for easy carrying. The protruding copper arms are available in three lengths, 6, 12 and 18 in. Replaceable special alloy tips are available in an assortment of shapes for specific needs. Each unit has a silicon-steel-and-copper transformer wound with spun-glass insulated magnet wire. Each portable spot-welder is supplied with 10 ft. of cable available for use with either 220- or 110-volt units.

Greyhound portable self-operating spot-welder

Portable Parts Cleaner

The Tivit portable parts cleaner stand is an all-welded steel unit, which can be wheeled right up to the job for dipping and cleaning small items. It holds a standard five-gallon can of Kelite Formula 555, a cleaner said to be fire-safe and quick-acting, and a five-gallon rinse can. A basket with a bale fits in the cleaner can.

The mechanic merely drops the grimy parts into the basket as they are removed from the job. After a short soak the basket is lifted out and dunked in the rinse can.

The Tivit portable parts-cleaning stand brings the cleaning operation to the job

Hinged drop-leaves at each side provide extra table space when required, and a tool tray at the bottom holds essential tools. The unit, 14 in. by 56 in. and 30 in. high, is mounted on ball-bearing casters. It is manufactured by Kelite Products, Inc., Box 2917, Terminal Annex, Los Angeles 54, Calif.

Single-Phase Capacitor-Start Motor

A single-phase capacitor-start, induction-run, squirrel-cage motor is available from the Westinghouse Electric Corporation in ratings of ¾, 1½, 2, 3, 5 and 7½ hp. It is of all-steel construction—steel frame, feet and end brackets.

This motor (Type CAP) utilizes the capacitor for starting only. The starting switch or relay disconnects the capacitor as the motor approaches full speed. It then operates as induction-run motor.

Air openings are in the lower half of the end brackets to give full protection against dripping liquids. Self-sealed, prelubricated ball bearings provide lubrication for five years or longer without repacking.

The motor can be used for practically any single-phase application, and is available for 60-, 50- and 25-cycle, single-phase, 110/20-volts dual voltage; 110-or 220-volt, single voltage; 3,450, 1,750, 1,160 r.p.m. for 60-cycles; 2,875, 1,475, 970 r.p.m. for 50 cycles, and 1,450 r.p.m. for 25 cycles.

Single-phase Life-Line Type CAP capacitor-start, induction-run squirrel cage motor

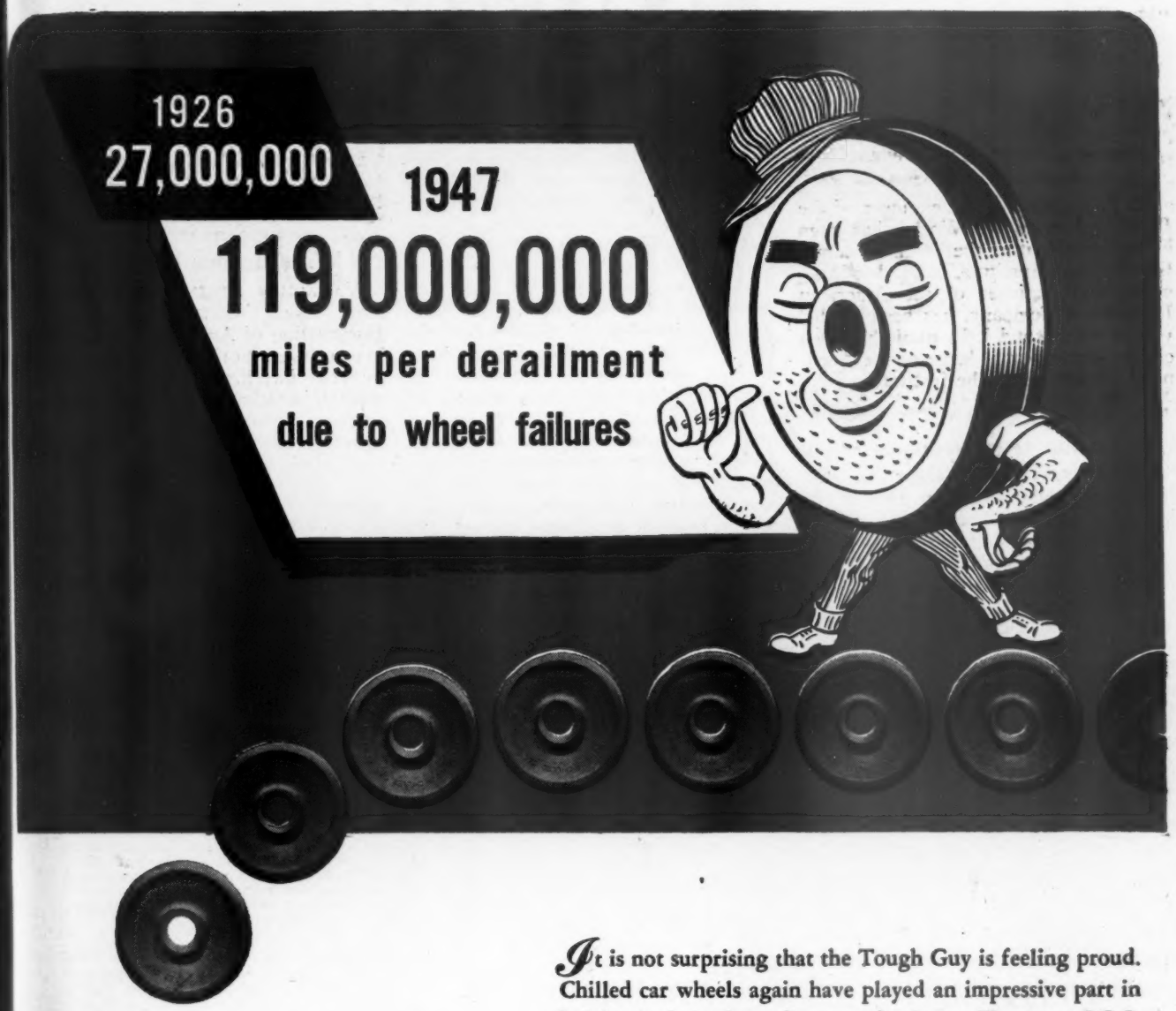
Shock Resistant Circuit Breaker

A palm-sized circuit breaker that will interrupt 5,000 amp. at 125 volts a.c. and withstand a mechanical impact up to approximately 150 ft.-lb. is available from the Westinghouse Electric Corporation, East Pittsburgh, Pa. It is designed for railway service, and similar places where vibration is prevalent.

Damping by a specially shaped bimetal overload element accounts for the breakers' ability to withstand high mechanical impacts. Using the over center principle in the circuit-breaker mechanism; contacts of special alloy, and a "De-ion" arc extinguisher, makes possible a fast-acting breaker with small contact separation.

The breaker is arranged for front-of-panel or rear-of-panel mounting. Mounting dimensions, exclusive of terminals and operating handle, are: length 3 in., depth 2⅛ in., and width 1-in.

Westinghouse Midget Shock Resistant Circuit Breaker



The Tough Guy
is proud of his
1947
Performance

It is not surprising that the Tough Guy is feeling proud. Chilled car wheels again have played an impressive part in helping an imposing safety record to be set. Figures on I.C.C. derailments for 1947 show *119,000,000* miles per derailment due to car wheel failure.

It wasn't so far back — little more than 20 years ago in fact — when this figure was 27,000,000 miles. And while advances in safety have been noteworthy over the long pull, advances in wheel making have set the pace which makes the records of recent years possible.

Where we at AMCCW come into this picture is the triple teamwork of our different classes of technical men: Resident Inspectors permanently located in members' plants, General Inspectors paying periodic visits of supervision, and trained metallurgists in our research laboratory. This combination of specialized personnel has resulted in almost spectacular improvement in chilled wheel safety.

AMCCW

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

NEWS

Steam Locomotive Research Institute Election

R. P. JOHNSON, chief engineer of the Baldwin Locomotive Works, has been elected president of the Steam Locomotive Research Institute, Inc. Alex Ross, mechanical engineer of the American Locomotive Company, has been elected vice-president, and J. B. Ennis has been elected a member at large of the Technical Committee of the institute.

Shop Improvements

THE Central of New Jersey has contracted for alterations on two of its buildings at the Elizabethport, N. J., shops at a total cost of $387,466. One of the buildings, now used as a locomotive machine, erection and boiler shop, will be converted into a Diesel-electric locomotive shop at a cost of $372,600. The other building will be changed from a freight-car repair shop to an engine-traction-motor repair shop at a cost of $14,866.

Locomotive Rules Amended

THE Interstate Commerce Commission has modified its rules and instructions for the inspection and testing of locomotives to remove the June 1, 1948, deadline from requirements calling for the installation, on steam locomotives built before March 1, 1946, of specified emergency brake valves, water gauges, and equipment for the auxiliary operation of air-operated power reverse gears. These requirements were set out in a January 16, 1946, order which stipulated that the installations be made the first time the locomotives received class 3 or heavier repairs, "but not later than June 1, 1948."

The modifying order, which eliminated that deadline, was dated April 27. It still leaves in effect the 1946 order's requirement that the installations be made the first time the locomotives receive heavy repairs. That order also still requires that steam locomotives built on and after March 1, 1946, be likewise equipped.

Equipment Depreciation Rates Prescribed for Two Roads

EQUIPMENT depreciation rates for the Chicago, Rock Island & Pacific and the New York Central are among those prescribed by the Interstate Commerce Commission in a recent series of sub-orders in the general proceeding, Depreciation Rates for Equipment of Steam Railroad Companies.

The rates for the Rock Island are prescribed in Sub-order No. 747, which is the initial sub-order for the reorganized company. They are as follows: Steam locomotives, 2.85 per cent; other locomotives, 5.52 per cent; freight-train cars, 3.39 per cent; passenger-train cars, 3.47 per cent; work equipment, 3.83 per cent; and miscellaneous equipment, 13.6 per cent.

The rates for the N.Y.C. are prescribed in Sub-Order No. 142-B, which is a modification of Sub-Order No. 142-A. They are as follows: Steam locomotives, owned, 3.4 per cent, leased, 3.8 per cent; other locomotives, owned, 3.3 per cent, leased, 6 per cent; freight-train cars, owned, 3.23 per cent, leased, 3.84 per cent; passenger-train cars, owned, 2.96 per cent, leased, 3.07 per cent; floating equipment, owned, 2.74 per cent; work equipment, owned, 3.84 per cent, leased, 4.07 per cent; miscellaneous equipment, owned, 15.5 per cent, leased, 17.84 per cent.

Miscellaneous Publications

VANADIUM STEELS FOR LOCOMOTIVE AND CAR CONSTRUCTION—Vanadium Corporation of America, 420 Lexington avenue, New York 17. 88 pages; 8½ in. by 11¼ in.; hard binding. Briefly describes, in technical sections on forgings, castings, springs, plate, and steels and irons for Diesel locomotive construction, each grade of canadium alloy steel and iron, with typical analyses for use in selecting most suitable composition for any specific application.

Orders and Inquiries for New Equipment Placed Since the Closing of the May Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Chicago Great Western	2[1]	6,000-hp. Diesel-elec. frt. (B units)	Electro-Motive
	3[1]	1,500-hp. Diesel-elec. frt. (B units)	Electro-Motive
	3[1]	1,000-hp. Diesel-elec. switch.	Electro-Motive
Grand Trunk Western	11[2]	3,000-hp. Diesel-elec. frt.	Electro-Motive
New York Central	12[2]	3,000-hp. Diesel-elec. frt.	Electro-Motive
	37[3]	1,000-hp. Diesel-elec. switch.	Electro-Motive
	4[2]	4,000-hp. Diesel-elec. frt.	Fairbanks-Morse
	2[2]	1,000-hp. Diesel-elec. switch.	Fairbanks-Morse
	2[2]	2,000-hp. Diesel-elec. transfer	Fairbanks-Morse
	6[2]	3,000-hp. Diesel-elec. frt.	American Loco.
	26[2]	1,000-hp. Diesel-elec. switch.	American Loco.
	10[2]	600-hp. Diesel-elec. switch.	American Loco.
Norfolk & Western	7[4]	2-8-8-2	Co. shops
	5[4]	2-6-6-4	Co. shops

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Chicago & North Western	1,000[5]	50-ton box	Pullman-Standard
	650[5]	70-ton hopper	Pullman-Standard
	650[5]	70-ton gondola	Bethlehem Steel
Norfolk & Western	100[6]	70-ton covered hopper	Greenville Steel Car
St. Louis-San Francisco	50	70-ton gondola	Pressed Steel Car
St. Louis Southwestern	50	70-ton covered hopper	American Car & Fdry.
Terminal R. R. Assn. of St. Louis	14	Cabooses	International Ry. Car & Equip.

FREIGHT-CAR INQUIRIES

Road	No. of cars	Type of car	Builder
Delaware, Lackawanna & Western	50	70-ton covered hopper	

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Wabash	6[7]	Sleeping	American Car & Fdry.

[1] The delivery of these locomotives—scheduled for the summer of 1949—will complete the road's Dieselization, with the exception of branch-line operations.

[2] Delivery of the locomotives is scheduled to begin in June, at the rate of two each month. Receipt of this equipment will increase the road's Diesel fleet to 47.

[3] Twenty-nine of the 37 1,000-hp. switching locomotives are for the Indiana Harbor Belt. Sixteen of the 29 will be used to make up 8 2,000-hp. transfer locomotives. The transfer locomotives also are for the Indiana Harbor Belt. Ten of the 26 1,000-hp. switching locomotives are for the Pittsburgh & Lake Erie. Delivery of the new equipment is scheduled for various times during 1949.

[4] Construction of these locomotives will begin after the completion of the ten 2-8-8-2's, expected for next December, which were reported ordered in the January issue of the *Railway Mechanical Engineer*. The new 2-8-8-2's will be compound Mallets of class Y6b, with simple tractive force of 152,206 lb. and a compound tractive force of 126,838 lb. The other five will be of class A, a single-expansion articulated locomotive with a tractive force of 114,000 lb.

[5] The Chicago, St. Paul, Minneapolis & Omaha, subsidiary of the North Western, will be alloted 150 gondolas and 150 hopper cars of the new order. Delivery of the box cars is scheduled to begin in August and deliveries of the hopper cars and gondolas will start in September and November, respectively.

[6] To cost approximately $750,000. Delivery is expected during the fourth quarter of the current year.

[7] Double-bedroom, 12-roomette type.

NOTE:

The Missouri Pacific Lines have been authorized by the district court at St. Louis, Mo., to purchase 45 Diesel-electric locomotives costing $11,166,600, and 1,000 70-ton hopper cars and 1,000 70-ton, 52½-ft. gondola cars costing an estimated $8,665,000. Twenty-three of the locomotives will be assigned to the M.P. as follows: 10 1,000-hp. switchers for service at Kansas City, Mo., replacing the present steam coal-burning locomotives now in use; eight three-unit 4,500-hp. freight locomotives for through freight service between Osawatomie, Kan., and Little Rock, Ark., on the road's Southern Kansas and Central divisions; one two-unit 3,000-hp. locomotive for service between Alexandria, La., and Houston, Tex., and four two-unit 4,000-hp. passenger locomotives, three of which will be assigned to the St. Louis-Texas run and one to the run between Little Rock and Lake Charles, La. The hopper cars also will be assigned to the M.P. The Gulf Coast Lines and the International-Great Northern, M.P. subsidiaries, will receive eight 3,000-hp. freight, two 4,500-hp. freight, four 1,500-hp. switching and eight 1,000-hp. switching locomotives. The gondola cars will be alloted in equal amounts to the G.C.L. and the I.-G.N.

PROBABLY no railroad man need be told that every carload of C & O's record-breaking tonnage moved behind steam.

Nor will it surprise many that almost every ton made most of its miles behind Lima-built locomotives.

The significant point is this: Here is an example of what *modern* steam power can do. It is a special example, to be sure, but a concrete one. Those are real locomotives, making real miles, moving real tonnage—and lots of it. Almost to an engine, they are modern—modern from the rims up, from the pilots back.

Could any other type of power—including older steam locomotives—have equalled C & O's cost per ton-mile?

We doubt it. That's why we say there *is* a place for steam—and in this place, the modern steam locomotive can do, and is doing, an outstanding job.

It's worth thinking about.

C. & O. Sets All-Time Record, Ships 90 Million Tons of Coal

this is steam at work

LIMA HAMILTON CORPORATION

DIVISIONS: ***Lima, Ohio***—Lima Locomotive Works Division; Lima Shovel and Crane Division. ***Hamilton, Ohio***—Hooven, Owens, Rentschler Co.; Niles Tool Works Co.

PRINCIPAL PRODUCTS: Locomotives; Cranes and shovels; Niles heavy machine tools; Hamilton diesel and steam engines; Hamilton heavy metal stamping presses; Hamilton-Kruse automatic can-making machinery; Special heavy machinery; Heavy iron castings; Weldments.

Supply Trade Notes

DEEMS SUPPLY CORPORATION.—*Robert J. Passani* has been appointed assistant to the president of the Deems Supply Corporation. Mr. Passani is a graduate

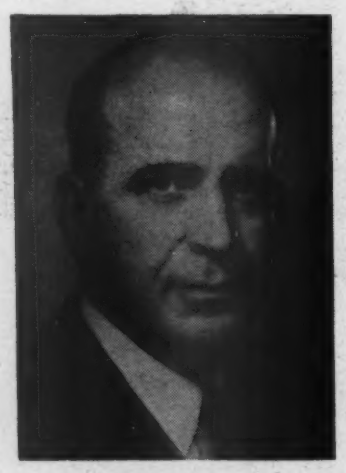
R. J. Passani

of the University of Vermont in 1925. Before joining Deems Supply, he was sales director for the Tempil Corporation of New York.

◆

BALDWIN LOCOMOTIVE WORKS.—*Frank B. Powers* has been elected assistant vice-president, engineering, of the Baldwin Locomotive Works.

Mr. Powers is a graduate of the University of Illinois (1926). He was



F. B. Powers

engineering manager for the transportation and generator division of the Westinghouse Electric Company until 1945 and subsequently was executive vice-president of Great American Industries, Inc. He joined Baldwin in January, 1947, as assistant to vice-president—operations, and in July of that year was given complete responsibility for all engineering activities of the Eddystone division.

◆

CANADIAN UNITCAST-STEEL, LTD.—The *Unitcast Corporation*, Toledo, Ohio, in cooperation with Canadian associates, has announced the organization of a subsidiary, Canadian Unitcast-Steel, Ltd., and the purchase, by its subsidiary, of the steel-casting foundry and business of the *Canadian Brake Shoe & Foundry Co.*, in Sherbrooke, Que. The new company's office will be located in Sherbrooke.

◆

AIR REDUCTION SALES COMPANY.—The apparatus sales and arc-welding sales departments of the Air Reduction Sales Company have been merged as the equipment sales department. *Dale D. Spoor*, formerly manager of dealer sales, has been appointed manager of the new department. *Ira B. Yates*, formerly manager of arc-welding sales, will manage arc-welding and supplies sales, and *J. F. Carroll*, formerly assistant to the apparatus sales manager, has been appointed manager of apparatus sales.

◆

WHITING CORPORATION.—The Chicago district sales office of the Whiting Corporation is now located at the First National Bank Building, 33 South Clark street, Chicago 3. The district sales office at Pittsburgh, Pa., is now located at the Empire Building, 505 Liberty avenue, Pittsburgh 22.

◆

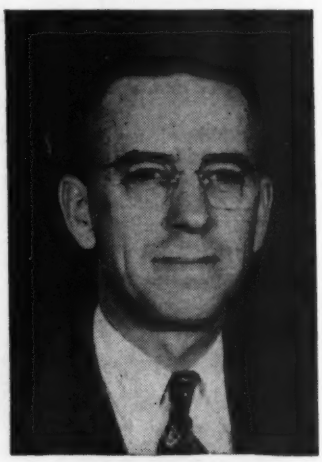
AMERICAN STEEL & WIRE CO.—*Lawrence F. Black*, superintendent of the engineering and maintenance department of the American Steel & Wire Co. (a subsidiary of the U. S. Steel Corporation) at Duluth, Minn., has been appointed assistant chief engineer, and *Charles B. Hull* assistant division engineer of construction. *John A. Slenker*, assistant general superintendent of the Duluth works, has been appointed general superintendent, succeeding the late *F. J. Martin*.

◆

CUMMINS ENGINE COMPANY.—*L. W. Beck* has been appointed vice-president—sales; *D. J. Cummins*, vice-president—engineering; *W. M. Harrison*, vice-president and treasurer; and *Carl R. Fox*, formerly vice-president and works manager, a director of the Cummins Engine Company.

L. W. Beck joined Cummins Engine nine years ago as manager of the central regional office at Chicago and has worked as general sales manager at Columbus, Ohio, headquarters since September, 1946. As vice-president, he will be in charge of all sales, service and advertising activities.

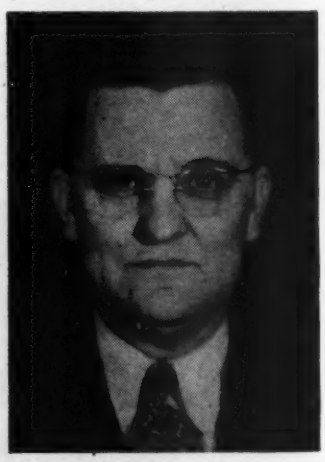
D. J. Cummins joined the company in



D. J. Cummins

1919 and was appointed manager of engineering in July, 1947.

W. M. Harrison has been with Cummins since 1943 and, at the time of his



W. M. Harrison

recent election, was treasurer and controller of the company.

L. W. Beck

◆

GENERAL AMERICAN TRANSPORTATION CORPORATION.—*Lester Selig*, vice-chairman of the board of directors of the General American Transportation Corporation at Chicago, has been elected chairman of the board, succeeding *Max Epstein*, who becomes chairman of the executive committee. *John P. McFadden*, eastern sales representative at New York, has been elected vice-president and a director, succeeding *Bennett Epstein*, who has retired. *Elmer Layden*,

A LOCOMOTIVE MODERNIZED WITH THE FRANKLIN SYSTEM OF STEAM DISTRIBUTION

handles . . .

more freight

. . . faster with less fuel and lower maintenance

There are no other changes or combinations of changes which you can make in existing steam motive power that will produce such fundamental improvements in locomotive performance as equipping the engine with the Franklin System of Steam Distribution, using poppet valves. Without increasing fuel consumption or boiler capacity, you can increase horsepower at normal operating speeds by 19% to 30%. When this greater power is not being utilized, you will normally achieve average fuel savings ranging from 15% to 25%, depending on operating conditions.

We would like to give you figures to show what can be expected in the way of improvements from your own locomotives.

On February 4th, Sante Fe's 4-8-4 type locomotive, No. 3752, re-entered service—modernized and equipped with the Franklin System of Steam Distribution, Type B. It went into regular freight service immediately and has continued in this service without interruption. It has proved its ability to handle heavier loads and has made some remarkable cuts in running time of heavy freights. While figures are not yet available it is evident that fuel and water consumption are substantially reduced. To date valve-gear maintenance has been practically nil and there is every indication that — with poppet valves, with the simplicity of the rotary valve-gear that has all driving parts located on the outside, and with improved drifting — machinery maintenance will be reduced and locomotive availability greatly increased.

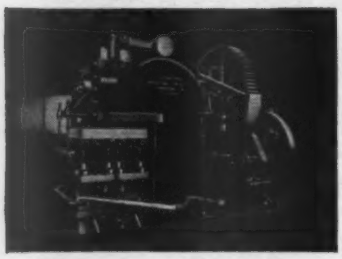
FRANKLIN RAILWAY SUPPLY COMPANY

NEW YORK • CHICAGO • MONTREAL

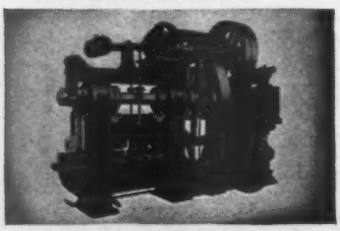
STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

For additional information, use postcard, pages 51-52

BEATTY Single End Punch available in capacities up to 200 ton.

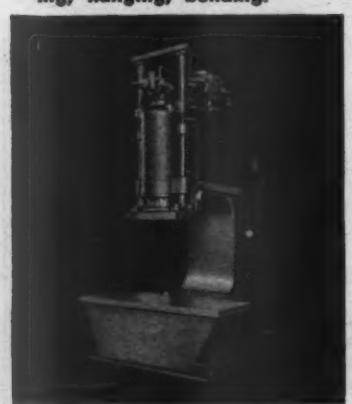


BEATTY No. 11-B Heavy Duty Punch for production tooling and use with BEATTY Spacing Table.

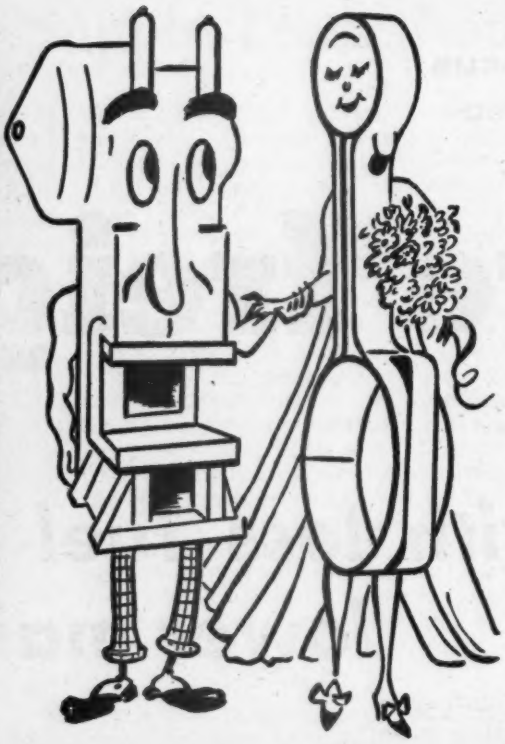


BEATTY Co-Pun-Shear — one unit does coping, punching, shearing.

BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.



BEATTY 250-ton Gap Type Press for forming, bending, flanging, pressing.



SHOTGUN WEDDING

Fast, low-cost production today demands machines correctly designed, correctly tooled for the specific job to be done. It *demands perfect mating* of machine to job, and this calls for the best engineering experience available to you. Here is where BEATTY ENGINEERING comes in. We know there is a BETTER way to do most production jobs. Our broad experience in finding that better way for so many companies is assurance that we can contribute to the solution of your problems. Write or phone us about your needs. Your best insurance for fast, quality production at a competitive cost is a BEATTY machine engineered to your specific needs.

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

formerly assistant to president of the Shippers' Car Line Corporation (subsidiary of the American Car & Foundry Co.) and special representative of A.C.F., with headquarters at Chicago, has joined General American as sales representative at Chicago.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*George L. Green*, formerly western district sales manager of the American Locomotive Company at Chicago, has joined the Pullman-Standard Car Manufacturing Company. Mr. Green will be in charge of miscellaneous sales at Chicago. *H. S. Hagan*, manager of works at the Hammond (Ind.), plant of Pullman-Standard, has been appointed acting manager of the company's plant at Butler, Pa., succeeding *R. M. Fox*, who has been granted a leave of absence. *Francis M. Gunn*, assistant to president, at Chicago, has retired after 56 years of service with Pullman-Standard.

◆

AMERICAN BRAKE SHOE COMPANY.—*Maynard B. Terry* has been appointed general sales manager of the American Brakeblok division of the American Brake Shoe Company. Mr. Terry, formerly manager of equipment sales, has

M. B. Terry

served in various sales capacities since joining the company in 1943. In his new position, he will continue to be located at the division's headquarters in Detroit.

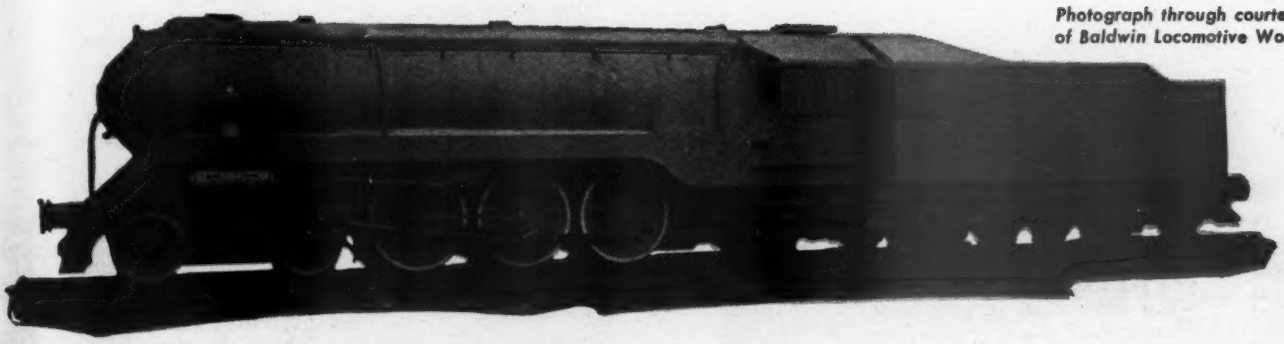
◆

RALSTON STEEL CAR COMPANY.—*John A. Dillon*, 280 Park avenue, New York, has been elected to the board of directors of the Ralston Steel Car Company. Mr. Dillon was formerly vice-president of the Pittsburgh Screw & Bolt Co., Pittsburgh, Pa., and more recently has been associated with the Office of Defense Transportation, Washington, D. C., and the American Car & Foundry Co., New York.

◆

PARKER APPLIANCE COMPANY.—The Parker Appliance Company, Cleveland, Ohio, has appointed the *Globe Machinery & Supply Co.*, Des Moines, Iowa, a distributor of its complete line of tube

Security circulators



Photograph through courtesy of Baldwin Locomotive Works

in Indian Railway Locomotives

The 4-6-2 locomotive illustrated has three Security Circulators in the firebox, an indication of the interest the Indian Government Railways is taking in the advantages of Circulators for coal-burning steam passenger locomotives.

This is another example of the steadily widening recognition of the effectiveness of Security Circulators for increasing the steaming efficiency of a locomotive.

AMERICAN ARCH COMPANY, INC.

NEW YORK • CHICAGO

SECURITY CIRCULATOR DIVISION

Safe Footing
No doubt about it! That's what you get when you install Inland 4-Way Floor Plate in your plant. This modern skid-resistant flooring, with its 4-way safety lug pattern, provides built-in protection and economy wherever feet or equipment must go . . . floors, walkways, ramps, platforms, steps. INLAND STEEL CO., 38 S. Dearborn St., Chicago, Ill. Sales Offices: Chicago, Davenport, Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, and St. Paul.
WRITE FOR BOOKLET
INLAND
Stocked by Leading Steel Warehouses
4-WAY FLOOR PLATE

fittings, valves and accessories for hydraulic and fluid-handling systems.

◆

LIMA-HAMILTON CORPORATION.—*Lisle F. Small,* formerly president of the United Engineering Company, has joined the engineering division of the Lima-Hamilton Corporation.

◆

GREAT LAKES STEEL CORPORATION.—*A. B. McCoy,* formerly St. Louis, Mo., representative for the Baldwin Locomotive Works, has been appointed by the Great Lakes Steel Corporation to handle sales of nailable steel flooring in the St. Louis area.

◆

HUNT-SPILLER MANUFACTURING CORPORATION.—*J. B. Hanks,* formerly traveling locomotive inspector of the Illinois Central, has been appointed sales representative in the middle-south territory for the Hunt-Spiller Manufacturing Corporation.

◆

REYNOLDS METALS COMPANY.—*Neil F. Ritchey,* formerly metallurgical engineer for the General Electric Company at Fort Wayne, Ind., has been appointed an engineer in the technical service department of the Reynolds Metals Company, Louisville, Ky. *Sublette M. Walton* has been appointed industry manager in charge of sales and all operation connected with the company's Alumi-Drome division.

◆

WINE RAILWAY APPLIANCE COMPANY.—*Thomas C. Fleming,* assistant to the president of the Wine Railway Appliance Company, since December, 1946, has been appointed vice-president. Mr. Fleming joined the company in 1941, before which he was assistant to the

T. C. Fleming

vice-president of the West-Penn Cement Company. Mr. Fleming remains also assistant to the president of the Unitcast Corporation, of which Wine Railway is a division.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION.—*Fred H. Johnson,* chief engineer of the Carnegie-Illinois Steel Corporation's Chicago district, has been ap-

50 MILLION GM Diesel miles on the Atlantic Coast Line

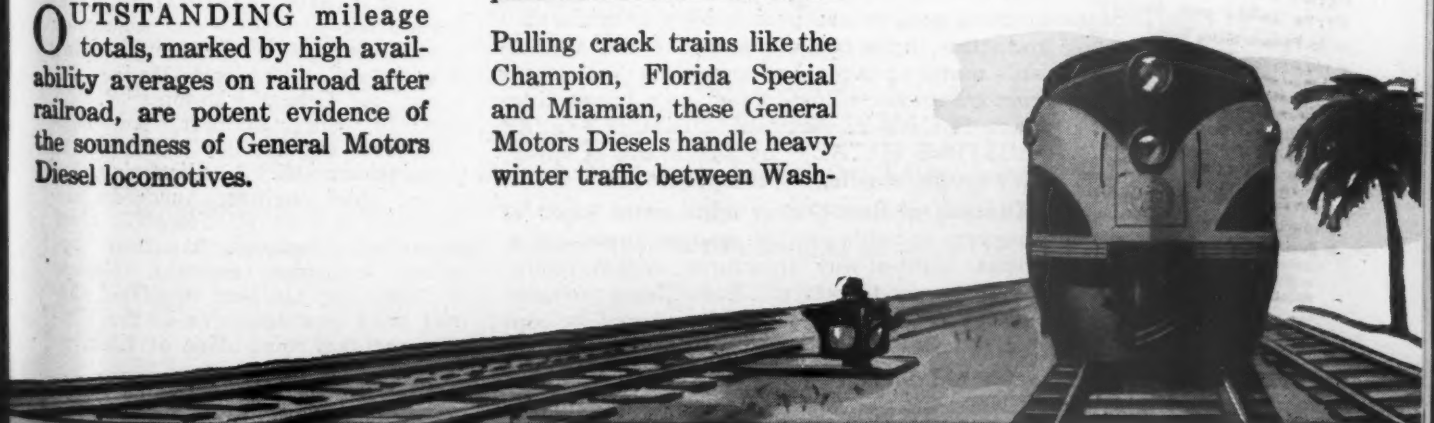
OUTSTANDING mileage totals, marked by high availability averages on railroad after railroad, are potent evidence of the soundness of General Motors Diesel locomotives.

Witness the tremendous record of 53 General Motors passenger Diesels on the Atlantic Coast Line. During the past eight years these locomotives have amassed a grand total of 50,000,000 miles — a monthly average of 15,825 miles per locomotive.

Together, they have met their assigned mileage 94.3% of the time. Twenty-nine of them, delivered between 1939 and 1942, have passed the million-mile mark.

Pulling crack trains like the Champion, Florida Special and Miamian, these General Motors Diesels handle heavy winter traffic between Washington and Florida — a run that ranges from rugged winter weather to extreme summer heat.

Here again, General Motors locomotives take the honors for fast scheduled operation with unparalleled passenger comfort, plus on-time performance matched by no other form of travel — all with operating and maintenance economies highly attractive to railroad management.



GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS LA GRANGE, ILL.

Home of the Diesel Locomotive

For Maintenance Savings . . .

STOP RUST

with

RUST-OLEUM

It's the Scientific Rust Preventive that Checks Rust by Water, Brine, Smoke, Heat, Weather, Uremic Acid, Etc.

Here's How RUST-OLEUM Saves Labor and Money

Less Preparation Time

- No sandblasting, flame cleaning or chemical dissolvers are necessary. Merely wirebrush to remove rust scale, dirt, etc.

Rust-Oleum Goes on Faster

- It saves 25% on application time and covers 30% more area per gallon. Excellent coverage, gallons of economy.

Enduring Protection

- Rust-Oleum outlasts ordinary materials two to ten times on most jobs, depending on conditions, under which it's used.

EASY TO USE
LASTING SATISFACTION
APPLY BY BRUSH, DIP OR SPRAY

Rust-Oleum Rust Preventives can help you to achieve greater net profits by a considerable reduction in the cost of maintenance of all rustable metal surfaces. Indoors or out—*wherever rust threatens*—Rust-Oleum cuts losses from rust. IT CAN BE APPLIED DIRECTLY OVER RUSTING METAL—by brush, dip or spray. It's tough, elastic, weatherproof!

The use of Rust-Oleum adds extra years of service to rolling stock, bridges, metal buildings, right-of-way structures, signal equipment, tanks, towers, etc. Rust-Oleum provides lasting protection for an average of ½ cent a square foot per coat material cost.

Get the facts NOW. Write today for Catalog No. 145.

RUST-OLEUM CORPORATION

2419 Oakton Street Evanston, Illinois

pointed assistant chief engineer at Pittsburgh, Pa. *David C. Affleck,* general supervisor, project engineering, of the Corporation's Gary Steel Works, at Gary, Ind., has been appointed assistant chief engineer.

◆

William S. Saylor, Cleveland, Ohio, has been appointed manager of the district sales office at Detroit, Mich. He succeeds *Francis C. Hardie,* who has been assigned other duties at Pittsburgh, Pa. Mr. Saylor is succeeded by *James T. O'Connor.*

◆

MORTON-GREGORY CORPORATION.—Purchase of the manufacturing assets and patent interests of the *Nelson Stud Welding Corporation* of Lorain, Ohio, and its associated companies, by the recently formed Morton-Gregory Corporation of Michigan, has been announced by *Henry J. Morton* of Detroit, Mich., president, and *George E. Gregory,* Toledo, Ohio, vice-president and general manager of the new firm. The Nelson manufacturing and engineering activities will be centralized at the Lorain plant, which will be known as the Nelson stud welding division of Morton-Gregory.

◆

IRON & STEEL PRODUCTS, INC.—*Frank M. Sweeny* has been appointed sales representative of Iron & Steel Products, Inc., with headquarters at Baltimore, Md.

◆

ARMCO STEEL CORPORATION.—The name of the *American Rolling Mill Company* has been changed to Armco Steel Corporation.

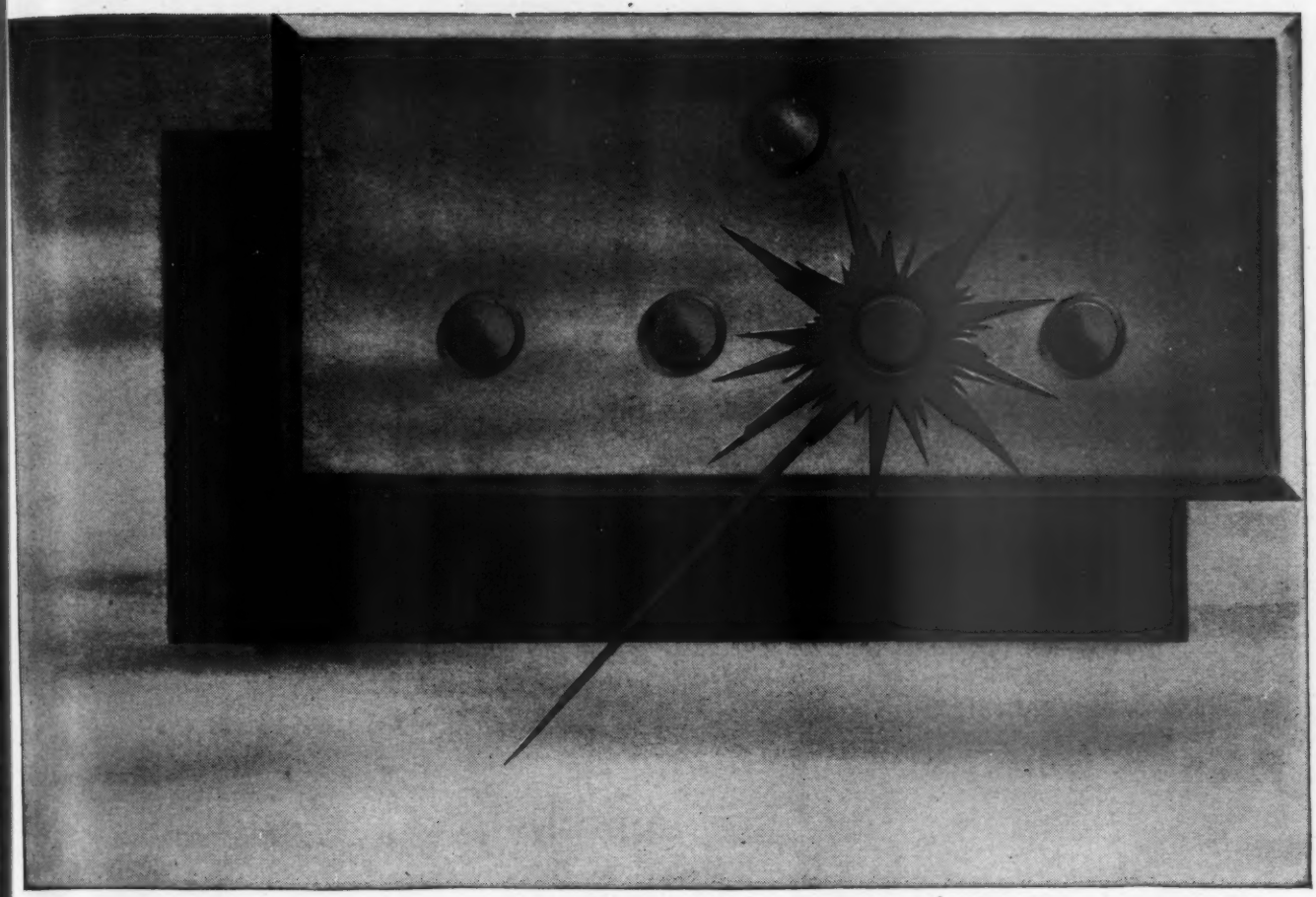
◆

STANDARD FORGINGS CORPORATION.—*Dana R. Cornell,* vice-president in charge of manufacturing of the Standard Forgings Corporation, has been elected a director to succeed *Charles R. Lewis,* a vice-president of the company, and *Arthur F. Reum,* formerly assistant vice-president, has been elected vice-president sales department.

◆

GENERAL MOTORS CORPORATION, ELECTRO-MOTIVE DIVISION—In connection with the expansion of the engineering activities of the Electro-Motive Division of General Motors, *R. M. Dilworth,* chief engineer, has been appointed engineering assistant to vice-president; *E. W. Kettering,* assistant chief engineer, succeeds Mr. Dilworth, and *L. F. Campbell,* chief production engineer, has been appointed executive engineer, *George W. Rukgaber* has been appointed district sales representative in the Chicago regional sales office of Electro-Motive.

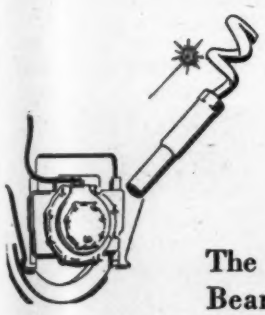
R. M. Dilworth began his career in the gas-electric rail-car division of the General Electric Company in 1910 as a construction machinist. Shortly thereafter he became an experimental machinist in the company's rail-car division and subsequently advanced



this new device keeps an

Electric Eye

on the bearings



The Westinghouse-Union Hot Bearing Detector brings an important new safeguard to passenger equipment. It solves the problem of hot bearing detection.

Any undue rise in the temperature of an individual bearing is immediately detected and reported—by red light to the train crew, by signal whistle to the engineer—BEFORE any damage results.

The device disregards temperature fluctuations due to weather and operating conditions; only the abnormal, threatening rise causes it to react.

Leaflet No. 2464 gives the complete story of principle and operation. We will be glad to send you a copy.

Westinghouse Air Brake Co.

WILMERDING, PA.

Brakes are Basic to Railroad Progress

Thomas scores another FIRST!

THE NEW T-D BILLET SHEARS

New

- in accessibility
- in floor-space economy
- in vital safety features
- in improved construction

Illustration shows 1200-ton T-D Billet Shear in large steel mill, used for obtaining test coupons from rollings of structural shapes.

● Once again Thomas pioneers a radical improvement in design . . . this time it's the new T-D Billet Shear.

All gears and moving parts are completely enclosed and the motor-drive is located overhead. Thus the T-D saves valuable floor space and provides greater safety and accessibility, in addition to lowering operating and maintenance costs.

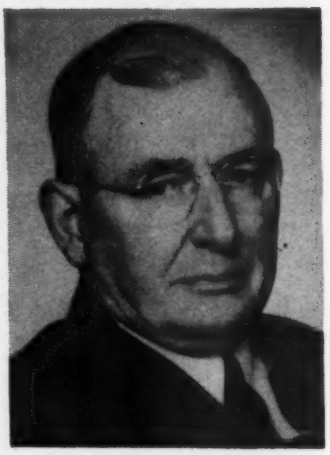
Ask for further information on this newest Thomas machine for industry!

THOMAS
MACHINE MANUFACTURING COMPANY
PITTSBURGH 23, PA.

20

PUNCHES · SHEARS · PRESSES · BENDERS · SPACING TABLES

through several positions connected with Diesel construction. Mr. Dilworth then went to the Philippines as construction superintendent for G.E. He later served as senior civilian engineer, Army Engineer Corps, in charge of the Manila and Subic Bay district. At the end of World War I he returned to the United States and became manufacturing engineer in charge of marine turbines and gears at the Erie, Pa., works of G.E. In 1923 he was transferred to the railway department and headed the sec-



R. M. Dilworth

tion working on gas- and Diesel-engine equipment. Mr. Dilworth became chief engineer of the Electro-Motive Engineering Company (now the Electro-Motive Division of General Motors) in 1926.

E. W. Kettering, who studied mechanical engineering at Cornell University, started his career as an experimental engineer in the employ of

E. W. Kettering

the Winton Engine Company, assisting in the development of the unit injector which later became a part of the new engine on which the Winton staff and the General Motors Research Laboratories were collaborating. He became experimental engineer for Electro-Motive at Detroit, Mich., in 1938, and, later, staff engineer in charge of engines. He was appointed senior project engineer

NAILABLE STEEL FLOORING*

Keeps Gondolas Off the Rip Tracks— Out of the Shops

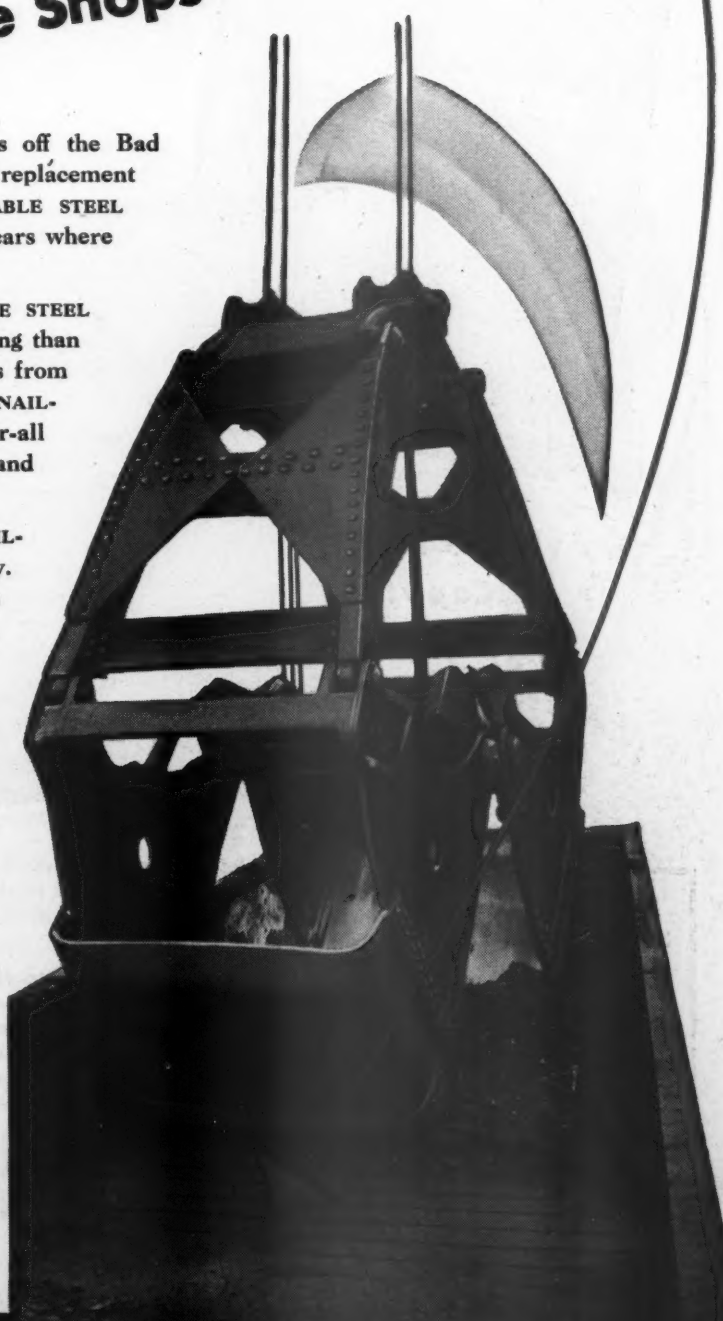
NAILABLE STEEL FLOORING helps keep gondolas off the Bad Order Report, saves you money in floor repair and replacement costs. Check these points that show *why* NAILABLE STEEL FLOORING cuts floor maintenance costs and keeps cars where they belong—on the line, bringing in revenue.

Greater Strength—Channel design gives NAILABLE STEEL FLOORING higher strength, more resistance to dishing than steel plate floors. After months of grinding impacts from magnets, hot pig iron and the clamshell shown, the NAILABLE STEEL FLOOR in a test car retained its over-all flatness and nailability, its suitability for blocked and skidded loads.

No Nail Damage—Nails can't rip or splinter NAILABLE STEEL FLOORING, can't damage it in *any* way. Held tighter than in wood, the proper size nails (20d or 30d in gondolas) are easily driven into the nailing grooves and can be readily removed.

High Rust Resistance—NAILABLE STEEL FLOORING is safer from rust because it's made from N-A-X HIGH-TENSILE steel which has three to five times the corrosion resistance of plain carbon steel and more than twice that of copper-bearing steel.

Combining nailability and strength, NAILABLE STEEL FLOORING does the job of both wood and conventional steel plate floors—and does each of them better. It saves money in operating as well as maintenance costs. When your next new car or rebuilding program comes up specify NAILABLE STEEL FLOORING.



NO TORN UP PLATES. This photograph shows gondola service at its roughest. Big clamshells like this ten-ton giant often tear rivet heads out of steel plate floors and rip up the cover plates. NAILABLE STEEL FLOORING *cannot* be torn up because it has no projecting rivet heads, no plate edges.

*PATENTS PENDING

NAILABLE STEEL FLOORING
A GREAT LAKES STEEL PRODUCT

GREAT LAKES STEEL CORPORATION
STEEL FLOOR DIVISION • PENOBSCOT BUILDING • DETROIT 26, MICHIGAN
UNIT OF NATIONAL STEEL CORPORATION

Better...Lower Cost Cleaning of Engine and Other Metal Parts

Write for a Copy!

For Diesel Parts Use Magnus 755

. . . the carbonized oil remover that made aviation history during the war and has gone on to new fields of superior service wherever these stubborn deposits have to be removed.

The Magnus Aja-Dip Cleaning Machine eliminates hand work on any part you have to clean, and it does its cleaning job faster and better than any other machine now available.

The repeated and dynamic roiling of the cleaning solution as the work is raised and lowered many times a minute in the solution provides constantly changing contact by fresh cleaning solution with all areas of the work. Moreover, it imparts a vigorous mechanical shearing action, by the solution, on the dirt.

Many railroads are now using these machines to cut costs, boost production and improve cleaning quality.

MAGNUS CHEMICAL COMPANY
77 South Ave., Garwood, N. J.
IN CANADA — MAGNUS CHEMICALS, LTD.
4040 Rue Masson, Montreal 36, Que.
Service representatives in principal cities

WITH RAILROADS IT'S
Magnus
CLEANERS • EQUIPMENT • METHODS

in 1942 and, subsequently, assistant chief engineer.

L. F. Campbell is a graduate of Sheffield Scientific School, Yale University (1920). He was in the business of automobile sales and service at New Haven, Conn., until 1929, when he became a carburetor inspector in the employ of the Pratt & Whitney Aircraft Company. He subsequently was assistant chief inspector, chief production engineer, and factory manager of the company's plant in Kansas City, Mo., until De-

L. F. Campbell

cember, 1944, when he became vice-president and works manager of the precision gear department of Foote Brothers, Chicago. Mr. Campbell became associated with Electro-Motive in 1945.

George W. Rukgaber was born at Hornell, N. Y., and was educated at Toledo University and New York University. Immediately, prior to his

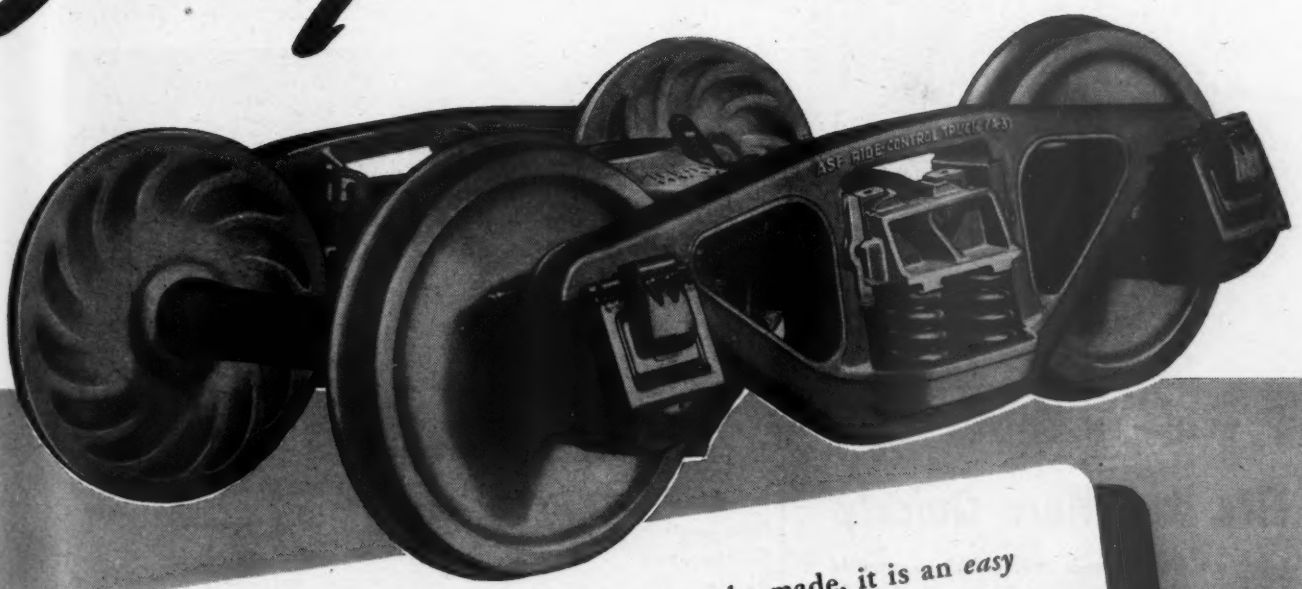
G. W. Rukgaber

appointment as district sales representative, Mr. Rukgaber was manager of the "Train of Tomorrow." Previously, he had been associated with General Motors for 19 years.

◆

GENERAL ELECTRIC COMPANY.—*John J. Huether* has been appointed manager of the transportation division, a new industry sales division of the apparatus department of the General Electric Com-

Easy to Shim



When coupler height adjustments must be made, it is an *easy operation* with A.S.F. Ride-Control Trucks. Simple rectangular shims may be applied and securely positioned directly above the spring group. No *special shapes* are needed. And, if desired, circular shims may be inserted in the flanged spring seat.

Ride-Control Trucks were not developed just for their now-famous *excellent riding qualities.* Few parts—all big and strong—assure utmost durability. Soundly engineered design assures *utmost convenience* in servicing.

A-S-F *Ride-Control* TRUCK

NO SPRING PLATES • NO SPRING PLANKS

LONG SPRING TRAVEL • CONSTANT FRICTION CONTROL

MINT-MARK OF ⬡ FINE CAST STEEL

For FASTER-CLEANER Fire Lighting

USE A

MAHR LOCOMOTIVE FIRE-OFF

Provides a *Better* Fire Bed *More Quickly*

Every roundhouse needs the MAHR Locomotive Fire Lighter. It provides safe speedy fire lighting . . . it cuts down smoke . . . it is portable . . . it saves time and money.

EASY TO OPERATE

The MAHR Locomotive Fire Lighter is easy to operate. Just spread coal evenly over the grates . . . turn on the roundhouse blower . . . insert the MAHR Fire-Off into the firebox . . . ignite and hold the nozzle over the fire bed. The nozzle supplies a hot wet flame which impregnates the coal making the entire lighting operation just a matter of a few minutes.

SPECIFICATIONS

Hose length	15'0"
Oil Hose, size	¾"
Air Hose, size	¾"
Tank capacity	20 gals.
Fuel: Kerosene, distillate or low grade fuel oil	
Air pressure required	80-100 lbs.
Wheels, diameter	24"
Height, overall	33½"
Floor space required	23" x 78"
Shipping weight	286 lbs.

USES SAFETY VACUUM PRINCIPLE

The fuel is drawn from tank by vacuum created by compressed air. The MAHR Fire-Off has no pressure on tank. Positively no danger of exploding tank or bursting oil hose. Unit has automatic air cut-off lever which if released for any reason, immediately extinguishes flame and lets oil flow back to tank.

The MAHR Fire-Off is a safe rugged unit that is constructed to give many years of dependable service.

Write for bulletin No. 450 today

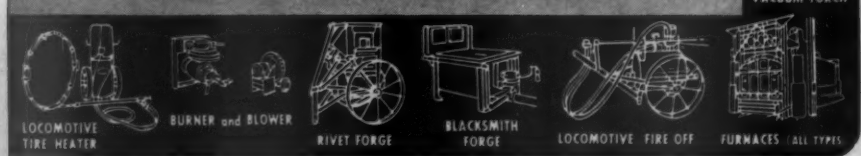
MAHR MANUFACTURING CO.

DIAMAHR

DIVISION OF DIAMOND IRON WORKS, INC.

MINNEAPOLIS, MINNESOTA, U. S. A.

VACUUM TORCH



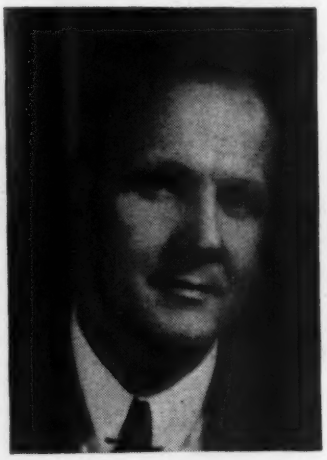
LOCOMOTIVE TIRE HEATER · BURNER and BLOWER · RIVET FORGE · BLACKSMITH FORGE · LOCOMOTIVE FIRE OFF · FURNACES (ALL TYPES)

pany. Mr. Huether was formerly manager of the mining and steel mill section of the industrial department.

◆

ARCOS CORPORATION. — The general offices of the Arcos Corporation, manufacturers of stainless and alloy electrodes, have been removed to Fiftieth street and Paschall avenue, Philadelphia 43, Pa.

JOHN C. DOLH COMPANY—*Walter E. Harvey* has been appointed director-product development and research of the John C. Dolph Company, to supervise a new research program. Mr. Harvey is a graduate of Pennsylvania State College (1932), with a

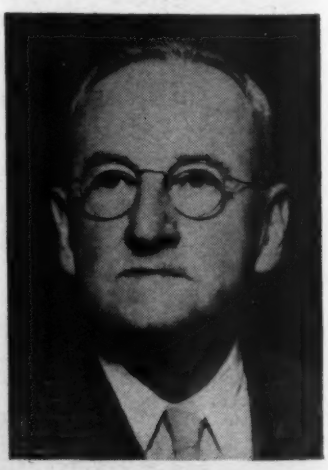


W. E. Harvey

B.S. degree in chemical engineering and of the University of Pennsylvania (1933), with an M.S. degree in science and chemistry. For the past nine years he has been employed by a manufacturer of insulating varnish.

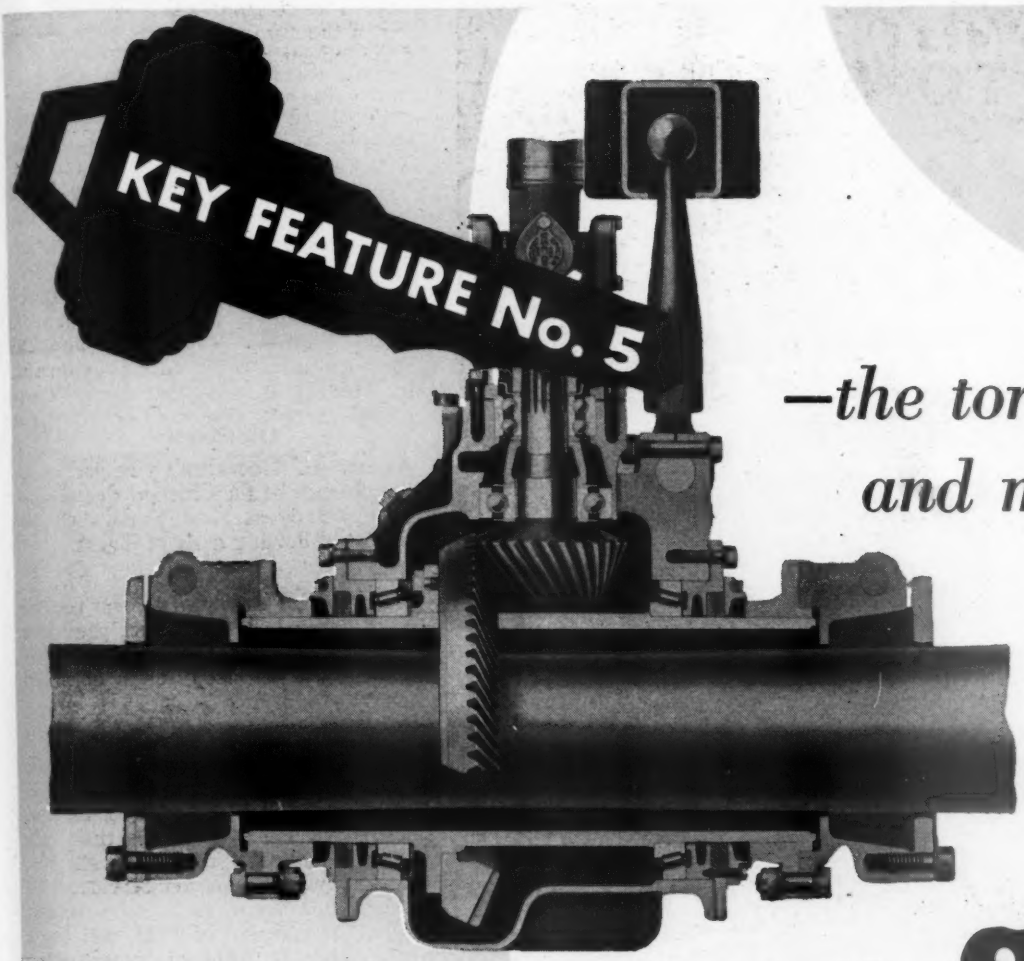
◆

THOMAS A. EDISON, INC.—*Arthur J. Loughren,* assistant general sales manager of the primary battery division of Thomas A. Edison, Inc., has retired after 37 years of continuous service with that company. Mr. Loughren entered rail-



A. J. Loughren

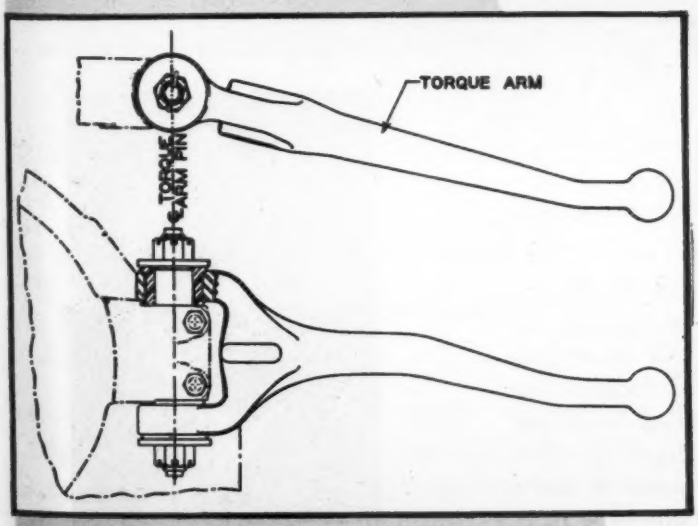
road service on June 1, 1893, as a batteryman on the Mohawk division of the New York Central, and subsequently became maintainer and then signal foreman on the Syracuse and Hudson divisions. In November, 1903, he was ap-



—the torque arm and mounting

in the **Spicer**

Models 6 and 6-1 POSITIVE GENERATOR DRIVE



The torque arm mounting attaches the torque arm to the end sill of the truck. The ball end of the arm is surrounded by two rubber blocks, which are enclosed by the housing. In the standard flex type of mounting, all movement, shock and vibration are absorbed by the rubber. Special slide type of mountings can be furnished when additional movement is required.

Smoothness and long life in the Spicer Generator Drive are helped by features in the torque arm assembly. The torque reaction of the gears is taken by the torque arm. One end is fastened to the gear housing and the other to the truck end sill. The torque arm is attached to the gear housing by two rubber bushings, which absorb shocks, vibration, and all movement by the flexing of the rubber. This prevents failures, and eliminates the necessity for lubrication.

There are more than 6,000 Spicer Positive Generator Drives in operation on 60 different railroads. Write for full information giving all the advantages available to your railroad with the Spicer Positive Generator Drive.

44 YEARS OF Spicer SERVICE

Positive Generator Drive

Manufactured, Sold and Serviced by **SPICER MANUFACTURING** Division of Dana Corporation • TOLEDO 1, OHIO

A Handy Guide for P. A.'s and Mechanical Men

If you have anything to do with the design, specification or purchase of springs for railroad equipment, you will want this book—a 28-page handbook of engineering data on springs—28 pages of formulas, graphs, charts, tables and drawings. This book will tell you all you need to know about specifying springs of any type from light wire to heavy coil and elliptic springs for any purpose. It's yours for the asking. Write for your copy today.

American-Fort Pitt Spring Division

H. K. PORTER COMPANY, Inc.

PITTSBURGH 22, PENNSYLVANIA

pointed assistant signal supervisor on the Hudson division and, in 1906, signal supervisor on the Harlem, Hudson and Syracuse divisions. He joined the primary battery division of Thomas A. Edison, Inc., on May 1, 1911 and subsequently was appointed assistant general sales manager.

◆

INDEPENDENT PNEUMATIC TOOL COMPANY.—The Independent Pneumatic Tool Company has removed its executive and administrative staff from Chicago to a newly constructed administration building adjacent to its main works in Aurora, Ill.

Obituary

ALLAN E. GOODHUE, vice-president and a director of the Chicago Pneumatic Tool Company at New York, died on April 20, following a short illness.

◆

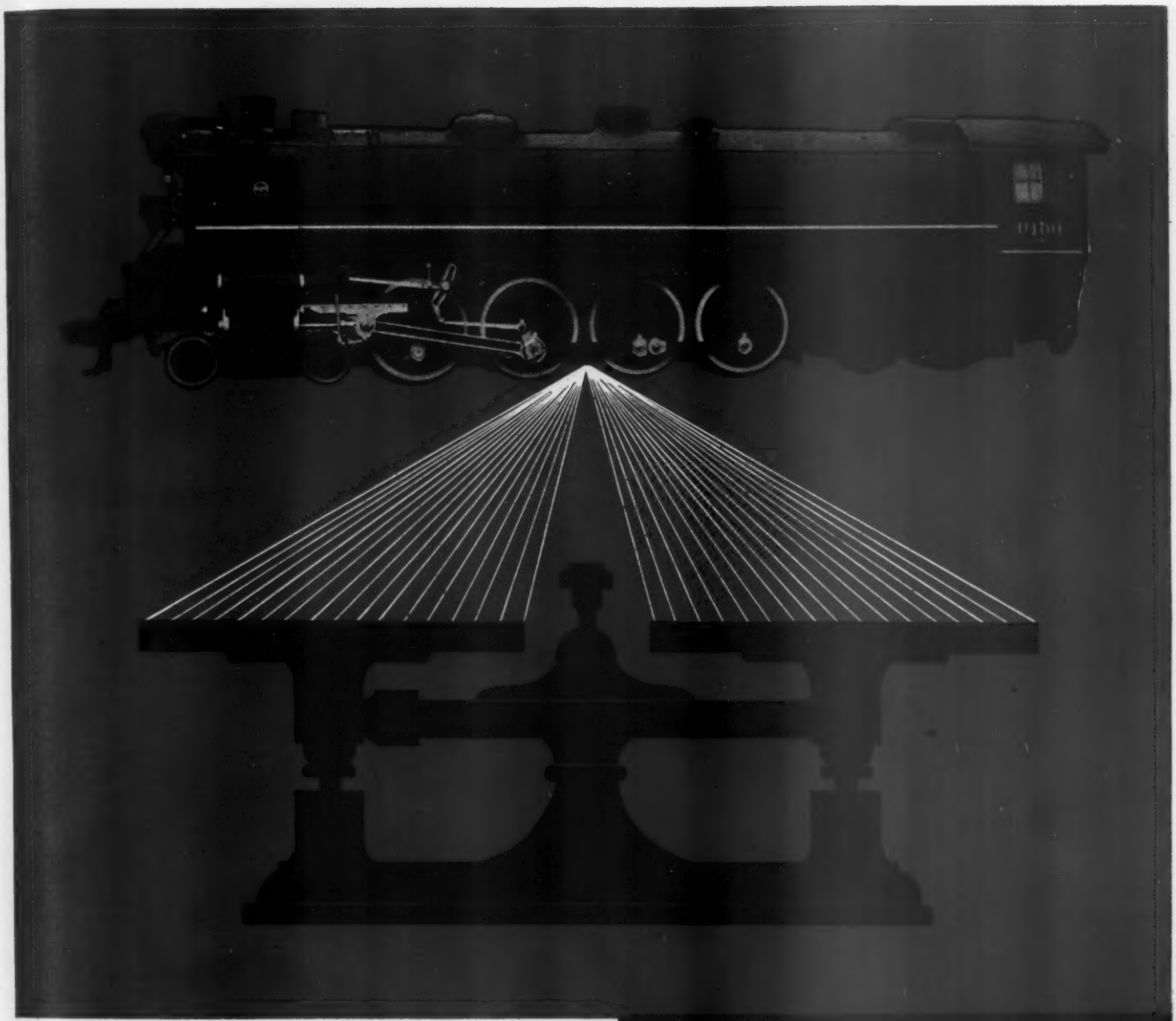
RUDOLF M. OSTERMANN, who retired on November 1, 1946, as vice-president of the Superheater Company, at Chicago, died in his sleep at his home in that city on May 5.

◆

H. A. MORRISON, retired vice-president of the Simmons-Boardman Publishing Corporation at Chicago, died at the Presbyterian hospital in that city on May 9 following a long illness. Mr. Morrison, who began his service with Simmons-Boardman as a sales representative at Chicago in 1925, was born on December 21, 1892, at Indianapolis, Ind. He studied electrical engineering at Purdue University and in 1912 entered the traffic department of the Penn-

H. A. Morrison

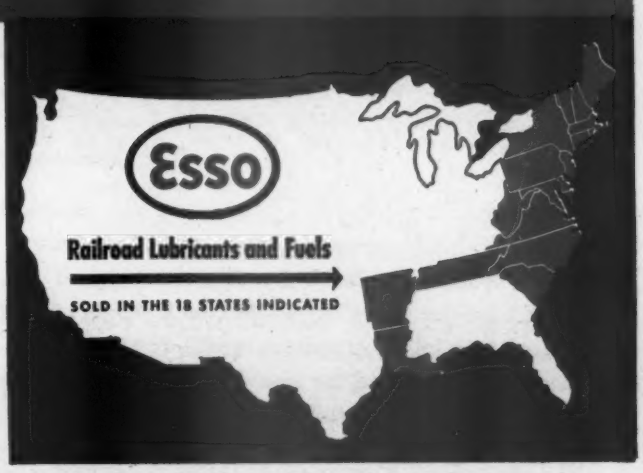
sylvania at Indianapolis. In 1915 he became a special apprentice in the electrical department of the Chicago, Rock Island & Pacific at Silvis, Ill. In June, 1918, he was transferred to the office of the general mechanical superintendent at Chicago. He resigned on September 1, 1919, to become sales engineer for the United States Light & Heat Corp., Chicago and on May 1, 1924, was appointed district manager of the railway sales department. On May 1, 1925, Mr. Morrison resigned as district manager of the United States Light & Heat Corp.,



Ever weigh a Locomotive on Laboratory Scales?...

Laboratory scales can't weigh a 150-ton locomotive ...but they do a lot better by constantly weighing and keeping tabs on the many Esso Railroad Products that speed trains along the nation's highways of steel.

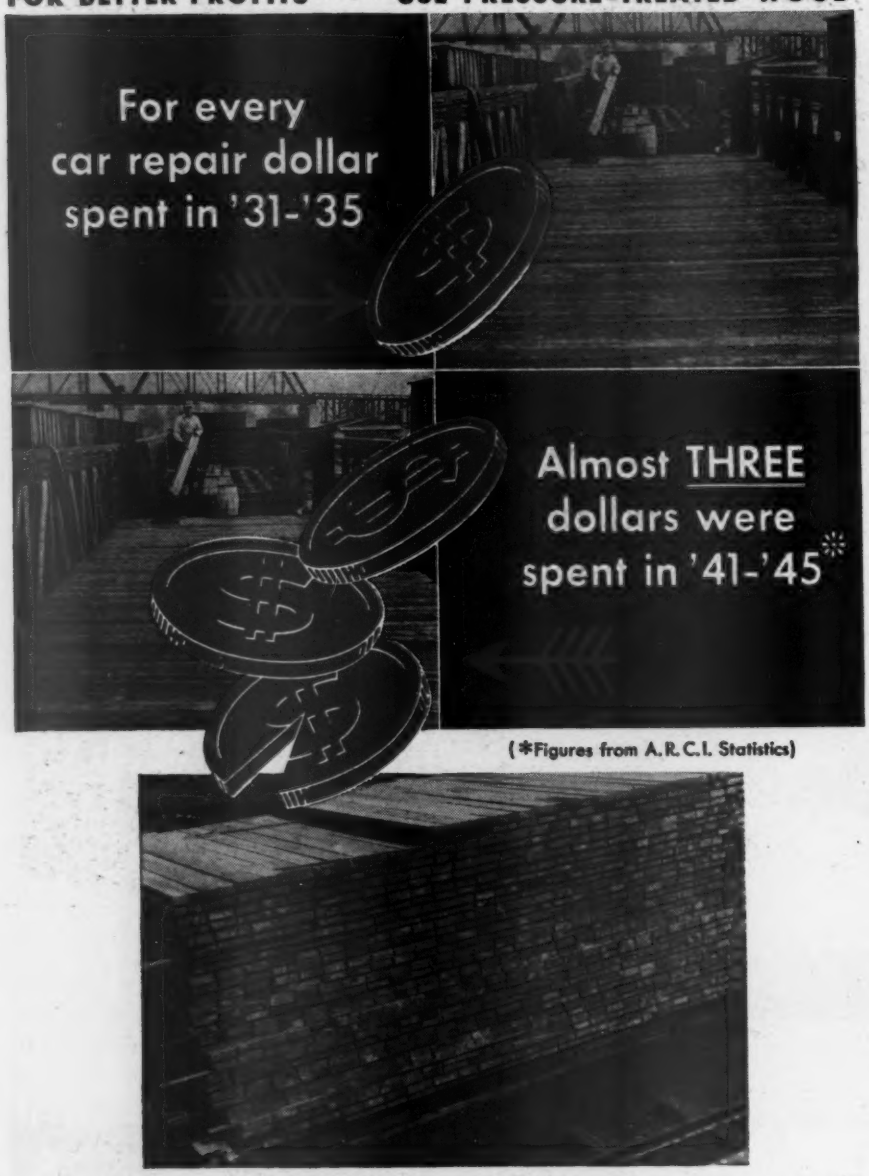
Developed in America's largest petroleum laboratories ...proved by accurate performance-records kept in thousands of "labs on wheels" over millions of rail-miles – Esso Fuels and Lubricants today meet *every* petroleum problem of the railroads!



ESSO STANDARD OIL COMPANY
Boston, Mass.—New York, N. Y.—Elizabeth, N. J.—Baltimore, Md.
Richmond, Va.—Charleston, W. Va.—Charlotte N. C.
Columbia, S. C.—Memphis, Tenn.—Little Rock, Ark.—New Orleans, La.
ESSO STANDARD OIL COMPANY OF PENNSYLVANIA
Philadelphia, Pa.

The Sign of QUALITY **Esso** *The Symbol of* SERVICE

FOR BETTER PROFITS • • • USE PRESSURE-TREATED WOOD



Let us help you Cut it Down!

Just for repairing *freight cars alone* the railroads paid out in 1946 over $85,000,000 more than they made in profits.

What's worse—the bill is steadily climbing. It was *almost three times as great* for the years from 1941 to 1945 as for the 1931-1935 period.

Part of this toll is needless waste *that can be stopped*—by using pressure-treated wood for car decks, gondola siding, stringers, nailing strips, and other vulnerable parts.

Many major railroads are already using pressure-treated wood to cut car repair costs, and so boost profits. Doubled and tripled life over untreated material has been reported. Let us help you to make these savings.

In new cars and for repairs, specify pressure-treated wood.

K KOPPERS

PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PENNSYLVANIA

to enter the service of Simmons-Boardman. On July 1, 1930, he was appointed business manager of Railway Signaling, a Simmons-Boardman publication, and on August 2, 1932, western manager in charge of sales in the western territory for all transportation publications of the company, continuing also as business manager of Railway Signaling. He was elected vice-president in November, 1937, retaining the responsibilities of both of the aforementioned positions until his retirement.

◆

WILLIAM E. CADE, a member of the Cade, Dwyer Company of Boston, Mass., for 45 years, died on April 22. Mr. Cade, who was 67 years old, had been secretary of the New England Railroad Club for 35 years.

Personal Mention

General

ANDREW J. FERENTZ, superintendent of the Buffalo division of the Lehigh Valley at Buffalo, N. Y., has been appointed assistant superintendent motive power-car, with headquarters at Sayre, Pa.

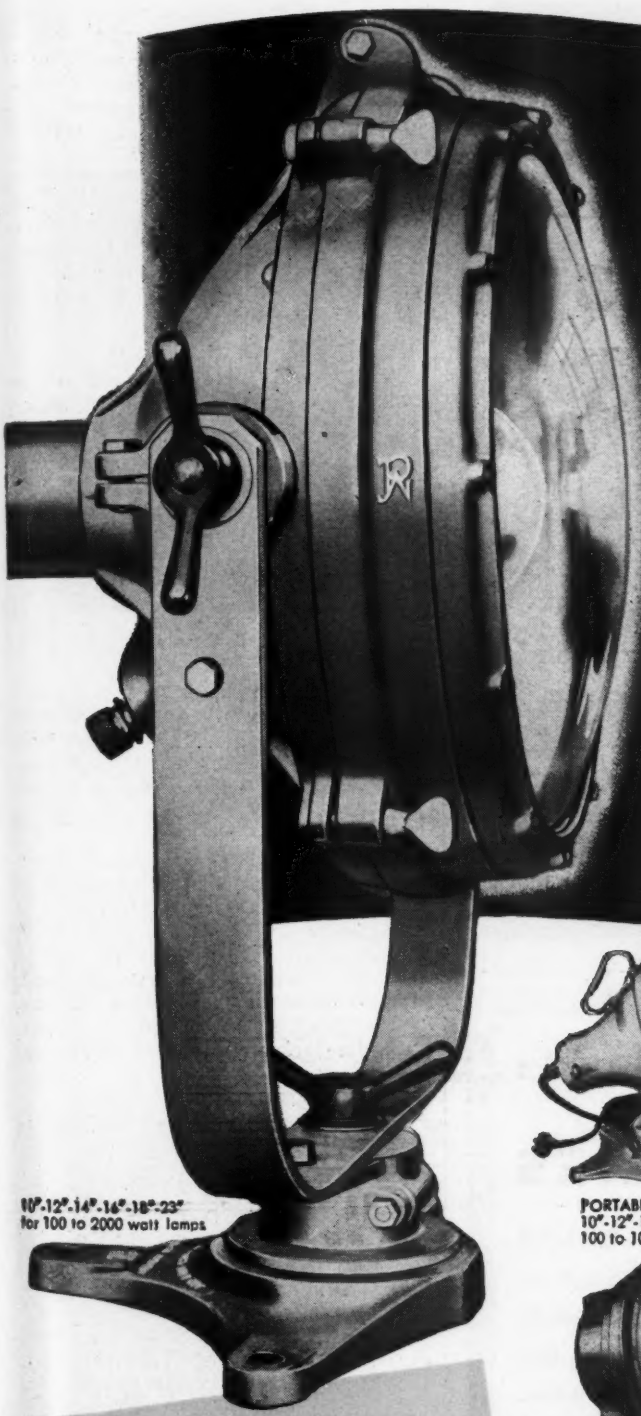
M. H. LINGENFELDER, master mechanic of the Pennsylvania at Harrisburg, Pa., has been appointed superintendent of the Wilkes-Barre, Pa., division.

W. H. GIMSON, assistant superintendent of motive power of the St. Louis-San Francisco at Springfield, Mo., has been appointed superintendent of motive power at Springfield.

JAMES E. BENFER, general engine-house foreman of the Gulf, Colorado & Santa Fe (a part of the Santa Fe system) at La Junta, Colo., has been appointed general mechanical inspector at Topeka, Kan.

W. B. BERRY, superintendent of motive power of the St. Louis-San Francisco at Springfield, Mo., has been appointed to the newly created position of chief mechanical officer at Springfield.

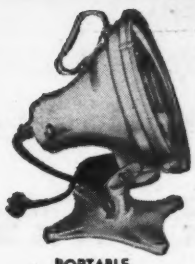
N. R. CRUMP, vice-president of the Eastern region of the Canadian Pacific at Toronto, Ont., has been appointed vice-president at Montreal, Que., with jurisdiction over all lines. Mr. Crump was born on July 30, 1904, at Revelstoke, B. C. He received his B. S. and M. E. degrees from Purdue University, and entered railroad service in 1920 as a machinist apprentice in the employ of the Canadian Pacific at Field, B. C., transferring to the western shops at Winnipeg, Man., in 1922. He attended Purdue from 1925 to 1929, after which he returned to his former post. In 1930 he became night foreman at Sutherland, Sask., and, later, shop foreman at Lethbridge, and Calgary, successively. In 1936 he was transferred to Regina, Sask. Mr. Crump was appointed chief mechanical draftsman, Western lines, at Win-



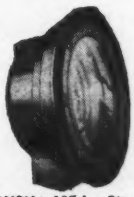
Specify— PYLE-NATIONAL FLOODLIGHTS

for Permanent Heavy-Duty Floodlighting

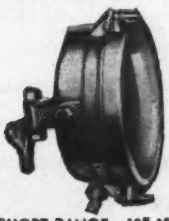
10"-12"-14"-16"-18"-23"
for 100 to 2000 watt lamps



PORTABLE
10"-12"-14"-16"
100 to 1000 watts



FLUSH—10" for Pit or Subway Wall or Ceiling
100-150-200 watts



SHORT RANGE—10"-12"
for Wall Mounting
100-150-200 watts

Dependable Floodlighting with Minimum Maintenance

Pyle-National floodlight equipment is designed and constructed to withstand the most severe operating conditions. Complete range of types and sizes are available.

RUGGED cast aluminum housings with tight sealing doors and door glass joints—positively dust proof and moisture proof—give maximum protection to reflectors and lamps and reduce cleaning and other maintenance to an absolute minimum.

STRONG, galvanized cast iron bases and brackets of many types are provided for simple mounting and accurate adjustment in all locations.

ADVANCED DESIGN of the carefully molded and highly polished reflectors and lenses insure the highest optical efficiency—thoroughly annealed for maximum toughness.

Write for catalog 2100 giving complete information.

The services of our trained and experienced floodlighting specialists are available at all times to advise and assist in installation problems.

SINCE 1897

THE PYLE-NATIONAL COMPANY

1358, NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

Offices: New York • Baltimore • Pittsburgh • St. Louis • St. Paul • San Francisco • Cleveland
Export Department: International Railway Supply Co., New York • Canadian Agent: The Holden Co., Ltd., Montreal

CONDUIT FITTINGS • PLUGS and RECEPTACLES • TURBO-GENERATORS • LOCOMOTIVE HEADLIGHTS • MULTI-VENT

DURAMETALLIC
Locomotive Packings
for THROTTLES

A Superior Packing for Superheated Steam and High Pressures . . .

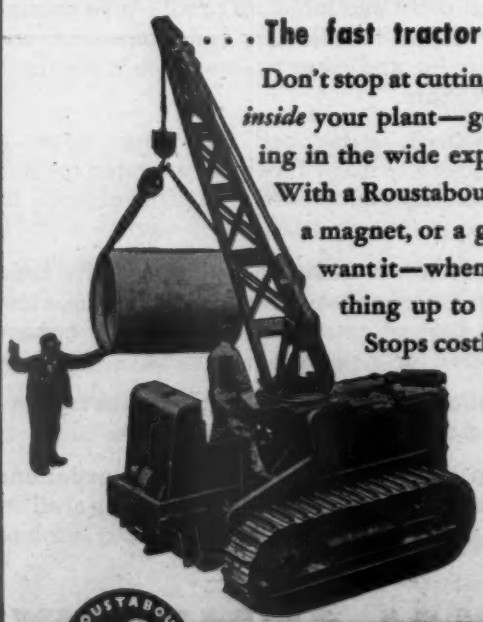
DURAMETALLIC STYLE D-911 PACKING

Durametallic Throttle Packing is supplied in ready-to-apply ring sets. Easy to install. Permits free operation of the stem. Provides a shopping to shopping service.

The PERFECT SEAL

DURAMETALLIC CORPORATION
KALAMAZOO MICHIGAN

Reduce Costs Outdoors as Well as In with
ROUSTABOUT CRANES



. . . The fast tractor-footed load hustlers

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nipeg in 1939; assistant superintendent of motive power for Western Canada in 1940; assistant to the vice-president in 1942, general superintendent, Ontario district, in 1943; assistant general manager, Eastern lines, Toronto, Ont., in

N. R. Crump

1944; general manager of the Eastern lines in January, 1946; vice-president and general manager of the eastern lines at Toronto in January, 1947, and vice-president of the Eastern region in August, 1947.

H. G. SMITH has been appointed acting superintendent of motive power of the International-Great Northern at Palestine, Tex.

W. H. JACKSON has been appointed superintendent of the Norfolk division of the Norfolk & Western at Crewe, Va. Mr. Jackson was born at Austin-

W. H. Jackson

ville, Va. He became a special apprentice in the Roanoke shops of the Norfolk & Western in June, 1923, later leaving to attend Virginia Polytechnic Institute, of which he is a graduate. He served in various capacities in the Roanoke shops and in the office of the superintendent of motive power, transferring to Bluefield, W. Va., as a shop inspector in March, 1934. Mr. Jackson was assistant road foreman of engines on the Pocahontas and Norfolk divisions and became road foreman on the former division in December, 1938. In 1940 he was

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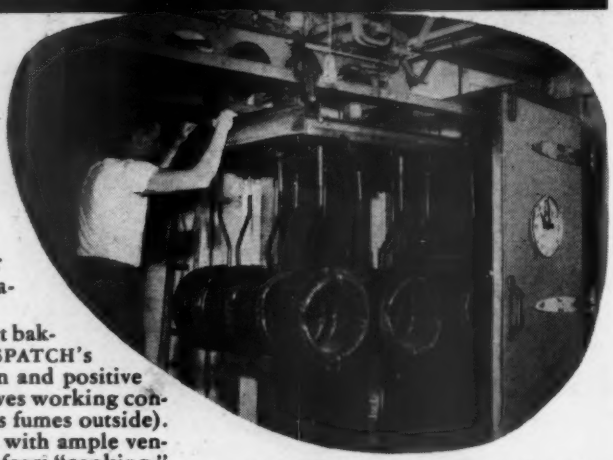

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appointed assistant trainmaster of the Scioto division and assistant superintendent on January 1, 1942. He was transferred to the Pocahontas division in February, 1944, and to the Norfolk division in February, 1948.

M. E. BOWMAN, shop inspector of the Norfolk & Western at Shaffers Crossing, Roanoke, Va., has been promoted to the position of assistant engineer of tests at Roanoke.

F. G. BAKER, electrical engineer of the St. Louis-San Francisco, has been appointed assistant superintendent of motive power at Springfield, Mo.

Car Department

ARTHUR H. KEYS, whose appointment as superintendent car department of the Baltimore & Ohio at Baltimore, Md., was reported in the May issue, entered the service in 1913 of the B. & O. at

A. H. Keys

Pittsburgh, Pa. He became car foreman at Youngstown, Ohio, in 1918; general car foreman at the Riverside shops at Baltimore in 1925; district master car builder at Glenwood, Pa., in 1933, and assistant superintendent car department at Baltimore in January, 1944.

SAMUEL R. FLOYD, assistant general foreman car repairs of the Southern at Spencer, N.C., has been appointed general foreman car repairs at Charleston, S.C.

HENRY G. CUNNINGHAM has been appointed foreman freight car repairs of the Southern at Meridian, Miss.

HARVEY E. SOWERS has been appointed foreman car repairs of the Southern at Winston-Salem, N.C.

L. E. HILSABECK, whose promotion to superintendent, car department, of the Chicago Great Western, with headquarters at Oelwein, Iowa, was reported in the April issue, was born November 4, 1898, at Marshalltown, Iowa. He began his railroad career with the Great Western in 1915 as a car repair helper at Oelwein, serving until 1917, when he joined the Navy for service during World War I. Re-entering the employ of the Chicago Great Western in 1919,

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Mr. Hilsabeck held various positions in the road's car department until 1931. He then became inspector foreman at the Oelwein terminal; later, car foreman and general car inspector, and, in 1941, assistant superintendent, car department, at Oelwein. In 1943 he was commissioned in the Navy, remaining on active duty in the European and Mediterranean theatres until July, 1946. He then returned to Oelwein as assistant superintendent, car department.

ODELL T. KESLER has been appointed foreman car repairs of the Southern at Winston-Salem, N.C.

WILLARD E. SAUNDERS has been appointed assistant general foreman car repairs of the Southern at Spencer, N.C.

JOHN C. CLARK, foreman planing mill of the Southern at Chattanooga, Tenn., has been appointed general foreman car repairs at Ludlow, Ky.

Master Mechanics and Road Foremen

JOHN A. THOMPSON, assistant road foreman of engines of the Southern at Knoxville, Tenn., has been appointed road foreman of engines, with headquarters at Knoxville.

DANIEL M. ANGLEMYER, superintendent system shops and enginehouse of the Lehigh Valley at Sayre, Pa., has been appointed master mechanic, Sayre shops.

F. M. MOZLEY, master mechanic of the Gulf, Colorado & Santa Fe (a part of the Santa Fe system) at Galveston, Tex., has retired.

G. R. WEAVER, assistant master mechanic of the Renova division of the Pennsylvania, has been appointed master mechanic of the Williamsport, Pa., and Wilkes-Barre divisions.

R. R. MCKINNEY, master mechanic of the Pennsylvania at Renova, Pa., has been appointed master mechanic of the Philadelphia division.

S. P. BYRNES, superintendent of motive power of the International-Great Northern at Palestine, Tex., has been appointed acting master mechanic at San Antonio, Tex.

J. W. YOUNG, assistant master mechanic of the Pennsylvania at Wilmington, Del., has been appointed assistant master mechanic of the Buffalo and Renova divisions.

W. C. ELLISON, general mechanical inspector of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed master mechanic of the Gulf, Colorado & Santa Fe (part of the Santa Fe System) at Galveston, Tex.

F. E. LACEY, master mechanic of the International Great Northern at San Antonio, Tex., has been granted a leave of absence due to ill health.

Shop and Enginehouse

W. A. JAMISON, assistant engineer of tests of the Norfolk & Western, at Roanoke, Va., has been appointed assistant welding supervisor at Roanoke.

T. J. STARON, gang foreman at the Connemaugh, Pa., enginehouse of the Pennsylvania, has been appointed assistant foreman at the Shire Oaka enginehouse, Monongahela, division.

C. W. LEWEY, assistant welding supervisor of the Norfolk & Western at Roanoke, Va., has been promoted to the position of foreman at the Iaeger, W. Va., shop.

P. T. TOLIN, foreman at the Meadows, N.J., enginehouse of the Pennsylvania, has been appointed foreman at the Mahoningtown enginehouse, Erie and Ashtabula division.

J. M. CARPENTER, assistant enginehouse foreman of the Pennsylvania at Enola, Pa., has been appointed assistant master mechanic of the Maryland-Delmarva divisions.

Obituary

GEORGE WERNER IMGRUND, retired vice-president of the Chicago & Illinois Midland, at Springfield, Ill., died in that city on April 24, following a heart attack. Mr. Imgrund, who just recently retired, was born on February 18, 1883, at Springfield. He entered railway service in 1897 as a machinist apprentice in the employ of the Wabash. Four years later, upon the completion of his apprenticeship, he became a machinist for a manufacturer at Springfield. In 1902 he became a machinist on the Baltimore & Ohio, at Newark, Ohio, and from December, 1902, until February, 1927, was, successively, enginehouse foreman on the B. & O. at Lorain, Ohio, and New Castle, Pa.; mechanical inspector on the Lake Shore & Michigan Southern (now part of the New York Central); a machinist on the Wabash; erecting foreman at Springfield, and enginehouse foreman at Chicago and Decatur, Ill.; general foreman of the locomotive and car departments and master mechanic of the Chicago, Peoria & St. Louis at Jacksonville, Ill. On February 1, 1927, Mr. Imgrund was appointed master mechanic of the Chicago & Illinois Midland. In November, 1930, he was appointed superintendent of motive power and equipment; on January 1, 1932, superintendent of the transportation, car, and locomotive departments, and in June, 1940, general superintendent. He was elected vice-president of the C. & I.M. in December, 1946.

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